S174B

THE NATURAL
HISTORY MUSEUM
20 MAR 2012
PRESENTED
GENERAL LIBRARY

LNHS

THE LONDON NATURALIST

Journal of the
LONDON NATURAL HISTORY SOCIETY

No. 90 2011

Natural History Museum Library
000141893

LONDON NATURAL HISTORY SOCIETY

The Society welcomes new members, both beginners and experts. Its recording area (the London Area) lies within a 20-mile (32-km) radius of St Paul's Cathedral and here most of its activities take place. Although much covered with bricks and mortar, it is an exciting region with an astonishing variety of flora and fauna. The Society is open to those interested in arachnology, archaeology, botany, conchology, conservation, ecology, entomology, geology, herpetology, mammalogy, ornithology, palaeontology, rambling, and all other aspects of natural history. The Society comprises various sections, but all meetings are open to members without formality.

Publications

The London Naturalist, published annually, contains papers on the natural history and archaeology of the London Area and beyond, including records of plants and animals.

The *London Bird Report,* also published annually, contains the bird records for the London Area for each year, as well as papers on various aspects of ornithology.

Bulletins of news items, including the Society's *Newsletter* and *Ornithological Bulletin,* are sent to members throughout the year.

Indoor meetings

These are held in most weeks throughout the year, with lectures, discussions, colour slides and films on all aspects of natural history.

Field meetings

Led by experts to visit interesting localities, both within and outside our Area. These excursions are very popular with beginners wishing to increase their knowledge, and enable members to get to know one another.

Library

A large selection of books and journals on most aspects of natural history is available for loan or consultation by members free of charge.

Reading circles

Many important natural history journals are circulated by the Sections at a fraction of the cost of subscribing direct.

SUBSCRIPTIONS

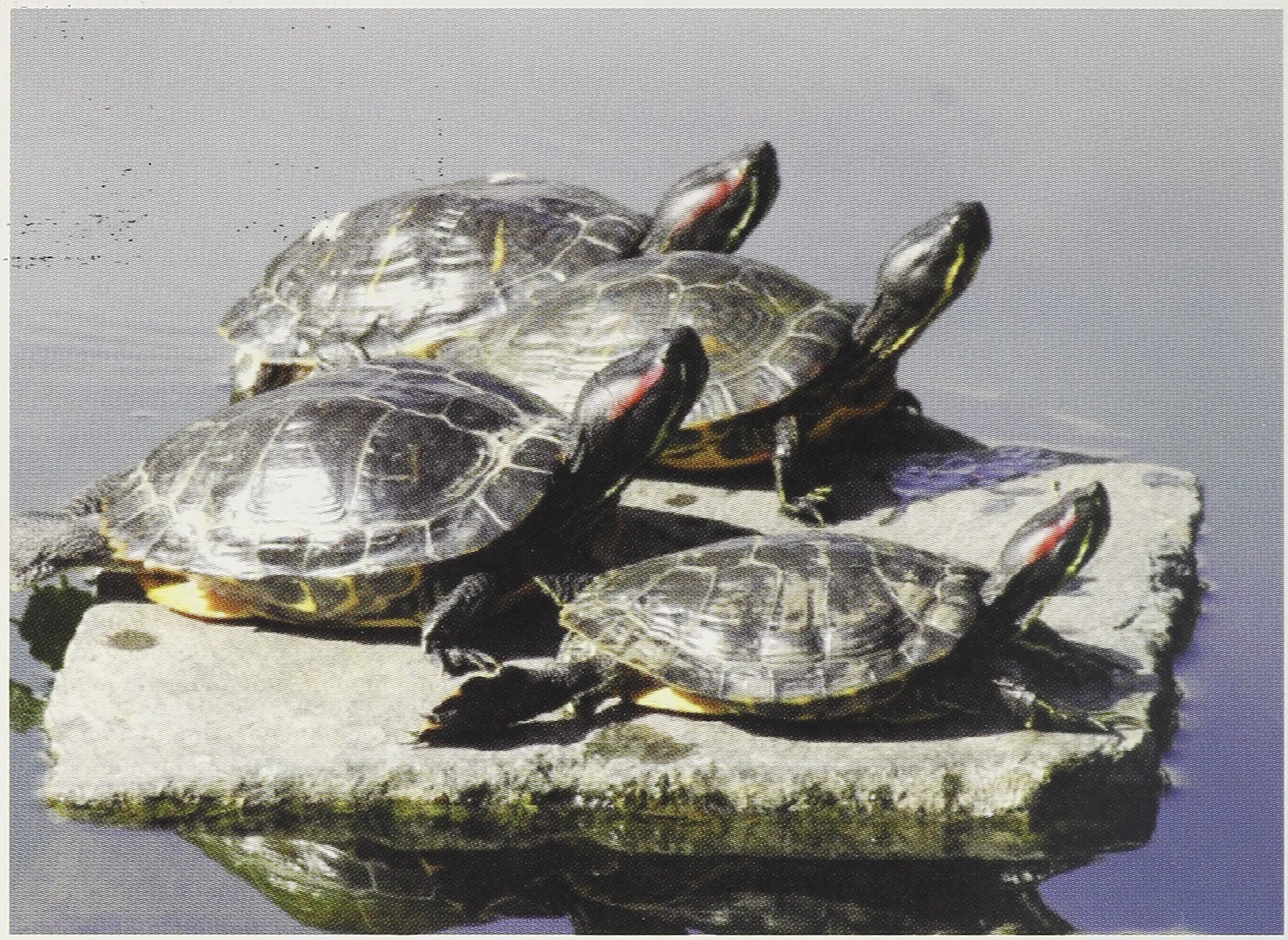
ORDINARY MEMBERS	£20.00
STUDENT MEMBERS	£5.00
SENIOR MEMBERS	£16.00
FAMILY MEMBERS	£4.00
CORPORATE SUBSCRIBERS	£20.00

Student membership is for persons under 18 or receiving full-time education, and senior membership is for persons over 65 who have been continuous members of the Society for ten complete years. All except family members receive one free copy of *The London Naturalist* and the *London Bird Report* each year. Cheques and postal orders, payable to the London Natural History Society, should be addressed to

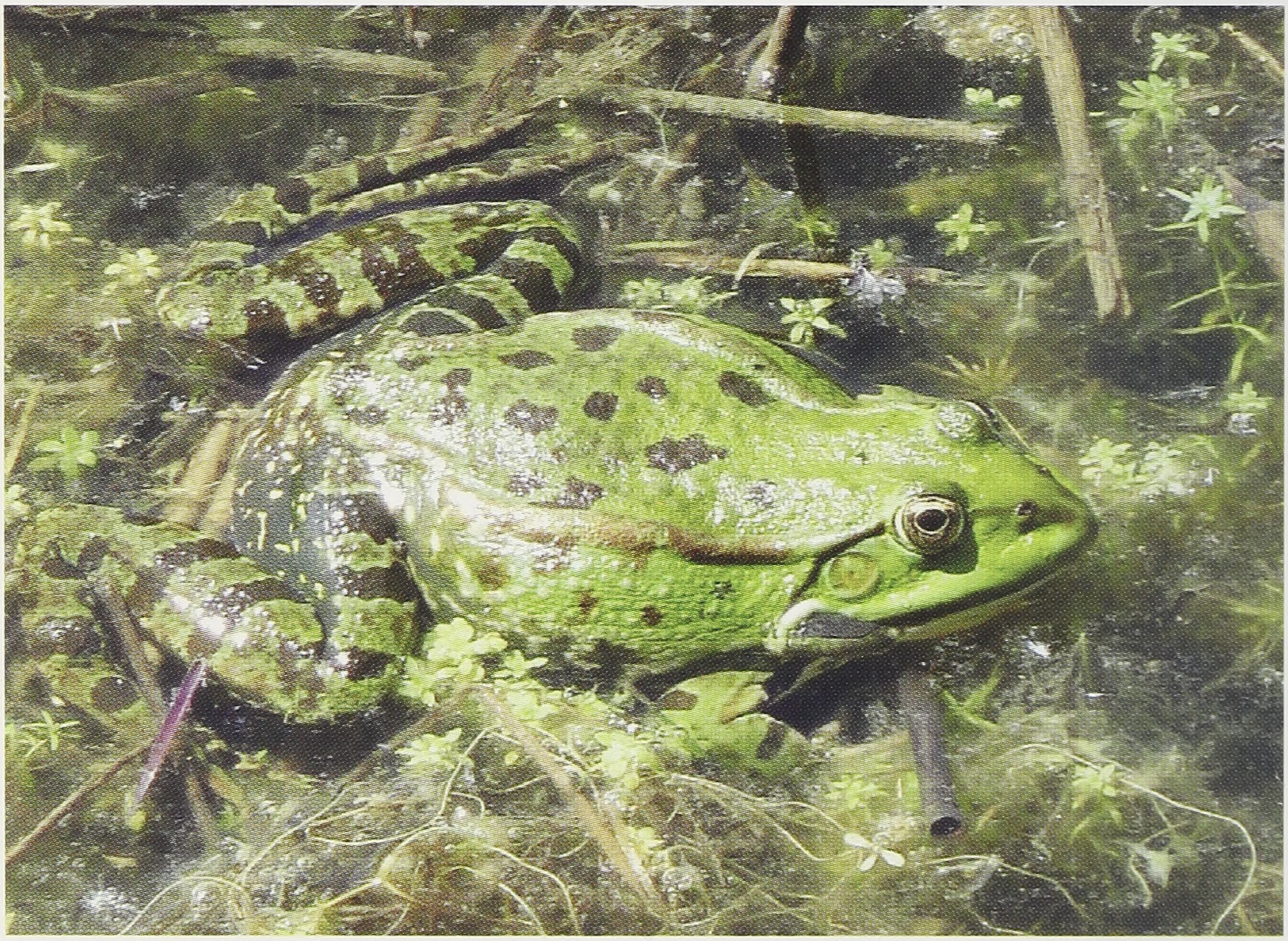
The Assistant Treasurer, LNHS,
Robin Blades,
32 Ashfield Road, London N14 7JY

THE LONDON NATURALIST

Further copies of this issue of *The London Naturalist* may be obtained (price £8 plus £1 postage and packing) from Catherine Schmitt, 4 Falkland Avenue, London N3 1QR. Back numbers of most recent issues of both *The London Naturalist* and *London Bird Report* are also available from the same address. Cheques should be made payable to the London Natural History Society.



Three red-eared terrapins and one yellow-bellied terrapin, basking prior to their capture at Sheepwash Pond, Barnet in 2006. *Photo: Liz Barrett*



Water Frog; 'marsh frog type', from RSPB Rainham Marsh, Havering in 2010. *Photo: Howard Vaughan*

See page 83.

THE LONDON NATURALIST

THE NATURAL
HISTORY MUSEUM
20 MAR 2012
PRESENTED
GENERAL LIBRARY

Journal of the
LONDON NATURAL HISTORY SOCIETY

No. 90

for the year 2010

Edited by K. H. Hyatt

Readers are respectfully advised that the publication of material in this journal does not imply that the views and opinions expressed herein are shared by the editor, the London Natural History Society, or any party other than the named author or authors.

Published December 2011

© London Natural History Society 2011

www.lnhs.org.uk

ISSN 0076 0579
ISBN 0 901009 28 8
World list abbreviation: *Lond. Nat.*

Bona fide researchers may quote from this publication without charge provided that the source is acknowledged.

Printed by Cravitz Printing Company Limited
1 Tower Hill, Brentwood, Essex CM14 4TA
cravitzprinting@btconnect.com

LONDON NATURAL HISTORY SOCIETY

Founded 1858

President

JOHN EDGINGTON, PH.D.
19 Mecklenburgh Square, London WC1N 2AD

Honorary Vice-Presidents

A. J. Barrett, R. M. Burton, MA, FLS, D. Bevan, FLS, P. C. Holland, K. H. Hyatt, FLS, R. A. Softly.

Officers for 2011

Vice-Presidents: C. Bowlt, B.SC., PH.D., FLS, J. F. Hewlett, PH.D., D. J. Montier, C. W. Plant, B.SC., FRES, P. J. Sellar B.SC. (ENG.), FRGS, MBOU, R. J. Swindells, H. M. V. Wilsdon, MBOU.

Secretary: D. Howdon, 381B Whitton Avenue East, Greenford, Middlesex UB6 0JU.

Treasurer: M. J. West, 52 Trinity Road, Ware, Hertfordshire SG12 7DD.

Assistant Treasurer and Database Manager: R. A. Blades, 32 Ashfield Road, London N14 7JY.

Librarian: D. W. Allen, 29 Huddleston Park, London N7 0AD.

Editor, *The London Naturalist:* K. H. Hyatt, 1 Tremcelynog, Rhandirmwyn, Llandovery, Carmarthenshire SA20 0NU.

Editor, *London Bird Report:* P. Lambert, 109 Gloucester Road, London E17 6AF.

Editor, *Newsletter:* M. Burgess, 92 Fellows Road, London NW3 3JG.

Editor, *Ornithological Bulletin:* D. McKenzie, 28 Braithwaite Tower, Hall Place, London W2 1LP.

Elected Members of Council: D. W. Allen, R. A. Blades, D. Dawson, J. Edgington, S. Graham-Brown, J. Hatton, K. H. Hyatt, M. Roberts.

Representative Members of Council: BOOKHAM COMMON SURVEY — S. Cole; BOTANY — T. Tuddenham; ECOLOGY AND ENTOMOLOGY — C. Schmitt; HAMPSTEAD HEATH SURVEY — K. Cavanagh; ORNITHOLOGY — D. Lindo.

The Society's Recorders

Botany

Flowering plants and vascular cryptogams: Dr M. Spencer, 72 Michael Cliffe House, Skinner Street, London EC1R 0WX (020-7837 1471).

Fungi and lichens: Prof. E. G. D. Tuddenham, 17 Bedford Road, London N22 7AU (020-8374 5167).

Bryophytes: P. Howarth, 15 Stuart Lodge, Ashley Road, Epsom, Surrey KT18 5AP (07920 143431).

Ecology and Entomology

Mammals: C. Herbert, 67a Ridgeway Avenue, East Barnet, Hertfordshire EN4 8TL (armconservation@hotmail.com).

Reptiles and amphibians: T. E. S. Langton, B.SC., 12 Millfield Lane, London N6 6RA (t.langt@virgin.net).

Fishes: Vacant.

Arachnida: J. E. D. Milner, B.SC., 80 Weston Park, London N8 9TB (acacia@dial.pipex.com).

Coleoptera (Carabidae and Coccinellidae): P. R. Mabbott, B.SC., 49 Endowood Road, Sheffield S7 2LY (paulmabbott@blueyonder.co.uk).

Coleoptera (Lucanidae and Buprestidae): Dr D. S. Hackett, FRES, 3 Bryanstone Road, London N8 8TN (danielhackett@blueyonder.co.uk).

Coleoptera (families not otherwise listed): M. V. L. Barclay, 47 Tynemouth Street, London SW6 2QS (m.barclay@nhm.ac.uk).

Soil-dwelling invertebrates (Myriapoda, Isopoda, Diplura): Andy Keay, 37 Merrymeet, Woodmansterne, Surrey SM7 3HX (andykeay01@aol.com).

Lepidoptera (butterflies): L. R. Williams, 34 Christchurch Avenue, Kenton, Harrow, Middlesex HA3 8NJ (leslie.williams1597@btinternet.com).

Lepidoptera (moths), Syrphidae, and invertebrates not otherwise listed: C. W. Plant, B.SC., FRES, 14 West Road, Bishop's Stortford, Hertfordshire CM23 3QP (cpauk1@ntlworld.com).

Orthoptera: Sarah Barnes, 33 Tavern Close, Carshalton, Surrey SM5 1JE (lnhs.orthoptera@virginmedia.com).

Hymenoptera Aculeata: R. W. J. Uffen, 4 Mardley Avenue, Welwyn, Hertfordshire AL6 0UD (01438 714968, ruffen@talktalk.net).

Hemiptera: T. Bantock, 101 Crouch Hill, London N8 9RD (tristanba@ googlemail.com).

Odonata: Neil Anderson, B.SC., 52 Beechwood Avenue, Greenford, Middlesex UB6 9UB (neil@anders42.freeserve.co.uk).

Plant galls: T. Root, 1 Whitecastle Mansions, Wakemans Hill Avenue, London NW9 0UX (trroot@hotmail.co.uk).

Mollusca: Vacant.

Records may be sent to the appropriate recorder (where shown) or to Colin Plant who will distribute to each recorder the relevant data from a mixed set of records.

Geology

Vacant.

Ornithology

Inner London: R. Bonser, Flat 7, 96 Rope Street, London SE16 7TQ (richbonser8181@hotmail.com).

Hertfordshire: Joan Thompson, 73 Raglan Gardens, Watford, Hertfordshire WD19 4LJ (lnhshertsrecorder@jksthompson.plus.com).

Buckinghamshire: A. V. Moon, 46 Highfield Way, Rickmansworth, Hertfordshire WD3 2PR (andrew.moon@talk21.com).

Kent and Lower Thames (London Bridge to Tilbury): J. Archer, 8 Smead Way, London SE13 7GE (john_archer@gofast.co.uk).

Surrey and Upper Thames (London Bridge to Staines): N. Tanner, 11 Collins House, Newby Place, London E14 0AX (nick_tanner@talk21.com).

Middlesex: S. Huggins, 206 East Ferry Road, London E14 3AY (seanhuggins@hotmail.co.uk).

Essex: R. Woodward, 62c High Street, Cheshunt, Hertfordshire EN8 0AH (roy.rkwoodward@ntlworld.com).

Requests for information should be made to the appropriate recorder.

Contents

Non-native herpetofauna in London . . . . *Frontispiece*

Officers for 2011 3

The Society's Recorders 4

Report of the Society for the year ending 30 June 2010 6

Official and sectional reports for 2010 13

EDGINGTON, JOHN — Early London botanists '. . . in the fieldes aboute London, plentuously . . .' 21

MCALISTER, ERICA — The Entomology collections at the Natural History Museum — from collection enhancement to public outreach 47

BEVAN, DAVID — Coppicing Haringey's ancient woodlands 55

LANGTON, TOM E. S., ATKINS, WILL and HERBERT, CLIVE — On the distribution, ecology and management of non-native reptiles and amphibians in the London Area. Part 1. Distribution and predator/prey impacts 83

LANGTON, TOM E. S. and HERBERT, CLIVE — On the distribution, ecology and management of non-native reptiles and amphibians in the London Area. Part 2. Disease impacts, perspectives, trade exploitation and finding ethical solutions 157

PLANT, COLIN W. and TERRY, RACHEL — Third update to the list of microlepidoptera of Middlesex (vice-county 21) 179

WILLIAMS, L. R. — London butterfly monitoring report for 2010 187

ANDERSON, NEIL — Odonata report for 2010 201

BANTOCK, TRISTAN — Hemiptera report for 2010 207

Survey of Bookham Common: sixty-ninth year Progress report for 2010 211

SPENCER, MARK — Botany report for 2010 235

Obituary:

RONALD MALCOLM PAYNE, 1922–2010 253

Book reviews index 256

Report of the Society for the year ending 30 June 2010

Approved at the Annual General Meeting on 15 December 2010

Objectives

The objectives of the Society are the study and recording of natural history, archaeology and other kindred subjects, especially within twenty miles of St Paul's Cathedral, the promotion of scientific investigations, the appreciation and conservation of the natural environment and the publication in the Society's journals of scientific and educational papers. Activities and achievements in respect of these objectives are described below.

Governance: Council, Committees and Sections

The Society is governed by a Council of Trustees, comprising the officers (president, treasurer, secretary), ten representatives of the members at large and one representative of each of the Society's Sections (currently five). Catherine Schmitt replaced David Howdon (now secretary) as Ecology and Entomology section representative, David Lindo represented the London Bird Club, and David Bevan the Botany Section. Stuart Cole remained as representative for the Bookham Common Survey.

Rule 4(c), limiting a continuous period of elected membership to five years, came into force in December 2005 and will first be implemented at the AGM in 2010.

The Administration and Finance Committee, chaired by Colin Bowlt, dealt with much delegated business.

Membership

Ninety-four new members joined during the year, down from 115 last year. The number of individual members currently stands at 984, compared with 1,003 at the same time last year, and 968 the previous year.

The Society is not just for experts — field meetings are planned with beginners in mind, and newcomers are encouraged to play an active part in the Society's affairs. Last year this report indicated that the Society was successful in securing funding from the Open Air Laboratory project (OPAL) to run a series of weekend events for family audiences, intended to enhance their knowledge of urban wildlife and to encourage a younger membership. Regrettably, difficulties with the administration of these events and getting access to a meaningful contact list for schools and the like (which we had thought our partners in the Linnean Society could provide) meant that it was not possible to organize these and the money was returned to OPAL.

We record with regret the deaths of the following members during the year to 30 June (date of joining in brackets): Mr Malcolm Cole (1979), Miss Rosa Davis (1932), Mr Geoffrey Gore (1948), Dr Tony Hare (1986), Mr Kenneth Jackson (1999), Mr Frank Lockwood (1977), Mrs Ray Millard (1978), Mr Mike Schickner (1973) and Mr David Stewart (1957).

Activities

Fieldwork has commenced for a new *Flora* of Greater London to replace Rodney Burton's *Flora of the London Area*. The area for the report will be the LNHS recording area, but recording efforts will be concentrated on the Greater London metropolitan area which has not had the same level of recent surveying as the outlying parts of our area. Members are encouraged to get out and 'bash a square' or two for this project.

The Ecology and Entomology Section continued to run a well-attended programme of field and indoor meetings covering a diverse assembly of taxa and developing a group of regular attendees as well as more occasional joiners. The Section again represented the Society at the annual exhibitions of the Amateur Entomologists' Society and the British Entomological and Natural History Society.

Under the brand of the London Bird Club (formerly called the Ornithology Section) the Society was involved in the launch of the Tower 42 sky-watching project by David Lindo (London Bird Club chair). This exciting project sees one of the tallest structures in London converted into a bird observatory in spring and autumn. LNHS involvement in the project means members are given priority for access to the places on the Tower.

Recording and recorders

The Records Policy, under which recorders should make their data available to the local records centre, Greenspace Information for Greater London (GiGL), was mentioned last year. Council reaffirmed its commitment of requiring all recorders to operate in accordance with this policy.

Steve Spooner resigned as Surrey and Upper Thames bird recorder. Nick Tanner took over in this role (although this actually occurred after the period of this report). Mary Clare Sheahan resigned as bryophyte recorder at the end of 2009, and in July 2010 (just after the end of the period of this report) Peter Howarth took on this role. Tristan Bantock was appointed recorder for Hemiptera, Sarah Barnes was appointed recorder for Orthoptera and Andy Keay was appointed recorder for soil-dwelling invertebrates (Diplura, Isopoda and Myriapoda) taking over the last two orders from Ken Hill who has also resigned as plant gall recorder. Thanks go to our outgoing recorders for all their work and a warm welcome is extended to those coming in.

Journals

The London Naturalist **88** (2009) was published in December 2009. No *London Bird Report* was published, although printing delays meant that the 2006 *LBR* (published in May 2009) was issued to members in September.

Library

This year saw the Society's library, until now held in storage at the Natural History Museum, transferred to the Angela Marmont Centre for UK Biodiversity at the NHM's Darwin Centre Phase 2, making it available to the public (for browsing) and LNHS members (for borrowing). The Society retains ownership of the library. Council agreed in principal that we need an electronic catalogue of the library — librarian Linda Hewitt and secretary of the Library Committee David Allen are exploring options for this.

Conservation of the natural environment

Rich habitats are still under threat from developers, though these threats are currently less likely in the depressed economic climate. The Society is often asked to lend its voice to protests against such developments. Council's view is that an appropriate campaigning body in such cases is the London Wildlife Trust, the LNHS being better placed to provide evidence-based advice if required.

This report has been prepared with due regard to the Charity Commission's guidance on public benefit.

Treasurer's report for 2009/2010

This year, the Society's accounts are presented on a receipts and payments basis, as permitted by the Charity Commission, which will be simpler and cheaper to produce in future years.

At the end of the financial year on 30 June 2010, the total net assets of the Society as detailed in the Statement of Assets and Liabilities were £322,829 compared with £337,181 the previous year.

The Receipts and Payments Accounts for the year show that payments exceeded receipts by £9,326 (2009: receipts exceeded payments by £1,996). The main reason for the shortfall relates to the reduction of Charities Deposit Fund Interest to £2,541 (2009: £14,459) as a result of lower interest rates. Since the year end, steps have been taken to transfer the majority of this investment to other funds with greater potential for income.

Receipts from members and supporters amounted to £25,723 compared with £29,457 the previous year, when the Society had benefited from bequests totalling £6,851 and anniversary conference income of £1,730. The high figure of £7,754 tax recovered on subscriptions and donations under Gift Aid is due to the processing of two years' claims during the period. Disregarding anniversary calendars, sales income from journals and other publications was £824, compared with £994 in 2009, reflecting slightly lower sales overall.

Total expenditure was £38,467, compared with £43,643 the previous year, when additional expenditure of £7,166 (plus higher mailing costs) was incurred in respect of the Society's 150th anniversary. Printing costs of *The London Naturalist* and *London Bird Report* were higher than the previous year, and steps are being taken to contain these costs in future. Library expenditure was also higher than the previous year, because of the cost of treating books before reopening in the Natural History Museum.

Reserves policy

The Society's unrestricted general funds can be regarded as expendable endowment since they are invested to provide a regular source of income as well as capital growth, over time.

Statement of trustees' responsibilities

Law applicable to charities in England and Wales requires the trustees to prepare financial statements for each financial year which give a true and fair view of the charity's financial activities during the year and of its financial position at the end of the year. In preparing those financial statements the trustees are required:

- to select suitable accounting policies and then apply them consistently
- to make judgements and estimates that are reasonable and prudent
- to state whether applicable accounting standards and statements of recommended practice have been followed subject to any departures disclosed and explained in the financial statements
- to prepare the financial statements on the going concern basis unless it is inappropriate to presume that the charity will continue to operate.

The trustees are responsible for keeping accounting records which disclose with reasonable accuracy at any time the financial position of the charity and enable them to ensure that the financial statements comply with the Charities Act 1993. They are also responsible for safeguarding the assets of the charity and hence for taking reasonable steps for the prevention and detection of fraud or other irregularities.

Independent examiner's report to the trustees of the London Natural History Society

I report on the financial statements of the charity for the year ended 30 June 2010 as set out below.

This report is made solely to the charity's trustees, as a body, in accordance with section 43 Charities Act 1993 (as amended). Our work has been undertaken so that we might state to the charity's trustees those matters we are required to state to them in this report and for no other purpose. To the fullest extent permitted by law, we do not accept or assume responsibility to anyone other than the charity and the charity's members as a body, for this report, or for the opinions we have formed.

Respective responsibilities of trustees and examiner

The charity's trustees are responsible for the preparation of financial statements. The charity's trustees consider that an audit is not required for the year (under section 43(2) of the Charities Act 1993 (the Act)(as amended)) and that an independent examination is needed.

It is my responsibility:

- to examine the financial statements (under section 43(3)(a) of the 1993 Act)
- to follow the procedures laid down in the General Directions given by the Charity Commissioners (under section 43(7)(b) of the 1993 Act)
- to state where particular matters have come to my attention.

Basis of independent examiner's report

My examination was carried out in accordance with the General Directions given by the Charity Commissioners. An examination includes a review of the accounting records kept by the charity and a comparison of the financial statements presented with those records. It also includes consideration of any unusual items or disclosures in the financial statements and seeks explanations from you as trustees concerning any such matters. The procedures undertaken do not provide all the evidence that would be required in an audit, and consequently I do not express an audit opinion on the view given by the accounts.

Independent examiner's statement

In connection with my examination, no matter has come to my attention:

(a) which gives me reasonable cause to believe that in any material respect the requirements:

- to keep accounting records in accordance with Section 41 of the 1993 Act
- to prepare financial statements which accord with the accounting records and to comply with the accounting requirements of the 1993 Act have not been met; or

(b) to which, in my opinion, attention should be drawn in order to enable proper understanding of the financial statements to be reached.

J. L. Meyer

Queen Alexandra House,
2 Bluecoats Avenue,
Hertford, Herts SG14 1PB

8 November 2010

Statement of assets and liabilities as at 30 June 2010

	2010		2009	
	£	£	£	£
Monetary assets				
Bank balances:				
National Westminster current account		—		(1,139)
National Westminster reserve account		**5,076**		15,512
Cash in hand		**469**		498
		5,545		14,871
Other monetary assets				
COIF charities deposit		**320,000**		320,000
		325,545		334,871
Non-monetary assets				
Equipment		—		146
Sundry debtors		**399**		5,830
Current liabilities				
Sundry creditors and accruals		**(3,115)**		(3,666)
Net assets		**£322,829**		£337,181

Approved on behalf of the trustees on 2 November 2010
J. Edgington – President
M. J. West – Treasurer

Receipts and payments account for the year ended 30 June 2010

Receipts	**2010**		2009	
	£	£	£	£
Receipts from members and supporters:				
Subscriptions		**16,745**		16,140
Donations and other income		**1,224**		665
Legacies		—		6,851
Tax recovered on subscriptions and donations under Gift Aid		**7,754**		4,071
150th Anniversary Conference		—		1,730
		25,723		29,457
Sales:				
Journals		**657**		743
The Butterflies of the London Area		—		28
The Breeding Birds of the London Area		**40**		62
London's Changing Natural History		**92**		143
Other publications		**35**		18
Calendars		**7**		333
		831		1,327
Charities Deposit Fund interest	**2,541**		14,459	
Bank Deposit Account interest	**5**		192	
Interest on Gift Aid tax recovered	**41**		204	
		2,587		14,855
		2,587		14,855
Total receipts		**29,141**		45,639
Less: total payments (below)		**(38,467)**		(43,643)
Net (payments) / receipts for the year		**(9,326)**		1,996
Cash at bank and in hand as at 1 July 2009		**14,871**		12,875
Cash at bank and in hand as at 30 June 2010		**5,545**		14,871

Payments

	2010		2009	
	£	£	£	£
Meetings costs, sectional and general expenditure:				
Hire of halls and rooms	**1,130**		936	
Lecturers' fees and expenses, sectional expenses etc.	**1,207**		692	
Postage and telephone	**196**		277	
Stationery	**93**		101	
Services	**173**		224	
Independent examiner's fees	**2,616**		2,644	
Insurance	**1,906**		1,906	
Honorarium and expense allowances	**124**		117	
150th Anniversary Conference	—		2,002	
Sundries	—		26	
Bank charges (net of refunds)	**20**		139	
		7,465		9,064
Grants payable:				
Grant to Hertfordshire Natural History Society for *The flora of Hertfordshire*	**1,000**		—	
		1,000		—
Publications:				
Printing and expenses:				
The London Naturalist No. 88	**6,596**		—	
The London Naturalist No. 87	—		5,802	
London Bird Report 2006	**5,306**		—	
London Bird Report 2005	—		4,072	
London's Changing Natural History	—		2,210	
		11,902		12,084
Programme	**588**		557	
Bulletin and *Newsletters*	**5,181**		6,313	
Mailing	**7,757**		10,342	
Calendar costs	—		2,954	
		13,526		20,166
Publications / journal sales expenditure		**221**		299
Library		**3,469**		1,048
Publicity		**884**		982
Total payments for the year		**£38,467**		£43,643

Official and sectional reports for 2010

CONSERVATION

This was another busy year for the London Biodiversity Partnership of which our Society has always been an active partner. Nic White, LBP Coordinator since 2006, stood down following a reorganization at Natural England. His role in guiding the Partnership during this period has been invaluable and he will be sorely missed. Amanda MacLean, previously LBP's hard-working Local Biodiversity Action Plan officer, has taken his place. Her earlier work with promoting local Biodiversity Action Plan projects within the London boroughs continued to achieve gains for wildlife in many parts of the capital. Several boroughs reviewed and revitalized their BAPs, while Hackney and Enfield set up new BAP partnerships and made big steps in the development of BAPs for the first time.

In Haringey, the BAP partnership has been working with GiGL on a map of green roofs, and at least four new ones were constructed in 2010. Meadow creation and meadow management went on apace in parks across the borough and Lordship Recreation Ground was the subject of a major restoration plan, with nature conservation paying a key part. The local Friends group and the BTCV have been pivotal in helping to implement improvements to both the lake and the woodland areas.

In Camden, 'Phase 1' habitat surveys were undertaken at a number of important sites, and a public wildlife survey was set up with advice from GiGL. Candidate areas were identified for the creation of wildflower meadows, reedbed restoration and pond establishment.

In Sutton, a wet meadow was created at Sutton Common Paddock and a programme of well-attended public events was run at nature reserves across the Borough. In Lewisham, there was an extensive programme of walks, talks, and volunteering. The last included river improvements and clean-up at Ladywell Fields. In Bexley, a hybrid black-poplar *Populus* × *canadensis* plantation at Woodland Way was replaced with a hectare of deciduous wet woodland, which included the native black-poplar *P. nigra* ssp. *betulifolia*. Black-poplar saplings were also planted at Marlborough Park and at Foots Cray Meadows, where eight new ponds were created. Horse grazing was introduced at Crossness LNR, and extensive lengths of ditches were desilted and reprofiled to improve drainage and provide better habitat for water voles.

Increasing numbers of Higher Level Stewardship agreements mean that more land was put into good management, not least in Bromley where several agreements were signed, focusing on getting woodland and chalk grassland into good condition.

Twenty parks have been participating in the London House Sparrow Project, run by the RSPB, to investigate what effect different types of grassland management have on the invertebrate communities that house sparrows feed on. It will be a while before the results are available, but hopefully they will eventually lead to improved management that will help our Society's own iconic species.

The Lee Valley Regional Park Authority created a new 'sand martin tower'. This is now the thirteenth of the Species Action Plan target of fifteen sand martin banks by 2020.

The reedbed Habitat Action Plan group continued to overachieve on its habitat creation targets, with new reedbeds being created in Richmond, Enfield, the Lea Valley, the Wandle and at East India Dock. The HAP group also organized a reedbed management workshop, visiting Rainham Marshes and Ingrebourne Marshes. This was the first in a planned series of workshops that aim to disseminate knowledge about reedbed restoration and management. Rainham Marshes and the River Ingrebourne also benefited from the work of the Rivers & Streams HAP group, with major projects to restore river habitats and several kilometres of ditches.

At Dagenham Washlands, a £12 million programme of flood-risk management is under way, with the creation of substantial new areas of acid grassland, wet fen, reedbed, ponds, wet woodland and river restoration.

Froglife is still delivering on pond creation and restoration targets, with particular successes in Havering and in Haringey, where an extensive pond was created on the site of a former derelict children's paddling pool in Queen's Wood.

LBP and GiGL's London Habitat Suitability Maps, which were trialled in 2009 (under the name 'opportunity maps'), were improved, completed and launched in August. Transport for London began using the maps to identify the best sites for habitat creation and restoration on London Underground land right across London.

A new group, linked to the London Biodiversity Partnership, got under way during the course of the year. This is the London Invasive Species Initiative (LISI) which holds a 'watching brief' to identify potentially troublesome invasive plants and animals and advise local authorities and other landowners on any actions needed to control or eradicate them. The 'usual suspects' are well known (Japanese knotweed *Fallopia japonica*, Himalayan balsam *Impatiens glandulifera*, etc.), but there are new arrivals that are causing concern, like the tree-of-heaven *Ailanthus altissima* which is causing structural damage in many parts of central London. The LNHS is well represented on LISI, with both the Conservation Officer and the Flowering Plant Recorder in regular attendance.

I am very grateful to Amanda MacLean for much of the information contained in this report.

DAVID BEVAN, *Conservation Officer*

BOTANY

At our AGM on 4 November, Edward Milner gave us a preview of his new book on the native trees of Britain. He noted the increasing public interest in trees, though publishers in his view have overemphasized 'champion' or 'heritage' trees and paid less attention to their ecology. His book will try to redress this imbalance. The book (forthcoming in 2011) will include a portrait of each native tree species — its history, distribution, uses, management and folklore. It will also, usefully, include details of the trees' ecology and interactions with other species. Many of these interactions have been investigated at the Biological Records Centre — particularly those involving phytophagous insects, and Edward has drawn extensively from this and other data. He pointed out that the genus *Salix* supports the greatest number of associated insects, more even than *Quercus*, although the latter is often claimed to support more. Most insects are restricted to one species of tree. A few trees such as box, yew and holly have chemical defences that resist attack and so have very few insects associated with them.

The distribution of trees can be difficult to track because the relevant maps published in the BSBI *New Atlas of the British and Irish Flora* (2002) often include planted trees, so that there is little indication of a species' natural range. Further confusion is caused by, for example, including both cultivated and wild crab apples, *Malus pumila* and *M. sylvestris*, on the same map. Edward also noted the puzzling distribution of the small-leaved lime *Tilia cordata* in the UK — how it survives on cliffs and in gorges in Cumbria, right at the edge of its range and apparently without sufficient viable seed.

Trees are also connected with spiritual traditions. For example, the association between trees and holy wells is widespread and the habit of hanging a rag or piece of cloth on trees as an offering is an almost universal tradition. Finally, Edward reminded us that the oldest tree in Middlesex is a yew *Taxus baccata* in Totteridge churchyard. We await the publication of his book with eager anticipation.

Indoor meetings began in January with the annual 'Best Botanical Photos' session, which gives members a chance to display their best photos of the previous year. At a joint meeting of the Botany, Ecology and Entomology, and Ornithology Sections, also in January, Mandy Rudd outlined the work of GiGL (Greenspace Information for Greater London). This is in essence London's Biological Recording Centre and plays a vital role in helping to conserve nature in the capital. The LNHS has always been an important contributor to GiGL through the data provided by our recorders. In February we held another lively 'Botany Quiz', ably and entertainingly presided over by George Hounsome and John Swindells. In May, Mark Spencer again ran a successful session on 'Botany for Beginners', which this time included information on how to record and how to use keys. In the summer, Mark also held a session on 'Grasses, sedges and rushes', and was joined by Ian Kitching to tackle 'Cotoneasters and other problems'. In October we heard David Bevan outline the findings of his recently launched 'Flora of Queen's Wood'.

The usual extensive programme of field meetings was organized by George Hounsome, our esteemed field meetings secretary. The 2010 season began in February when Mark Spencer and John Swindells led a winter botany walk in west London. In the spring, we visited West End Common and Oxleas Wood, while Ted Tuddenham led a fungus foray in Perivale Wood. In early summer there was a return visit to London Zoo (followed by a further visit in August) and excursions to Amberley for chalk downland flora, and to Hackney Marshes and Wick Woodland. During the remainder of the summer there was a varied progamme of visits to Beddington Farmlands, Haysden Country Park, Coppett's Wood and the Glebelands, Gallions Reach, and to Vange and Pitsea Marshes. Inner-city sites were explored in John Swindells' visit to The Barbican and his always popular 'Pot Luck in the East End', which this year focused on Whitechapel. In July, Nick Bertrand took us to the Thames footpath from Deptford to Woolwich, and in October to his favourite sites in the streets of Lambeth.

In September, Mark Spencer ran two recording sessions specifically for the *Flora of London*, in Colindale and in Crouch End. The year concluded with the renowned Haringey Fungus Foray, led as always by Ted Tuddenham, and followed by an indoor identification session at Railway Fields.

The Flora of London

Work on the new *Flora of London* is gathering pace: 2010 was the first year of formal recording. Coordinators have now been appointed for many of the ten-kilometre squares and records were collected from them at the end of 2010. Meanwhile collation of the data for 2009 is near to completion. Mark Spencer has produced a recording card of common plant species to be used by recorders. He has also compiled a list of desired workshops to support work on the flora. These workshops will make up most of the Botany Section's indoor meetings over the coming year. Two recording sessions for the *Flora* have already been held in north London (see above), and many more are being set up for 2011.

Some outstanding questions remain to be resolved, such as the handling of critical taxa. As Mark mentioned in his talk about the new *Flora*, there are also issues concerning the Society's capacity to cover the entire London polygon. Duplication of recording effort in the vice-counties adjoining the London Area remains a concern. There have also been some differences in approach to the recording of planted trees, for example. For further details see the recorders' reports below.

Recorders' reports

Mark Spencer reported that during 2010, the London Flora Project started to move into another phase. Several key tasks have been undertaken and further work identified, namely:

1. Nine project coordination meetings were held during the winter/spring of 2009/2010.
2. Guidelines for recording data were established.
3. Guidance notes on key issues are in preparation.
4. 10-km coordinators' roles have been agreed and volunteers located — more are needed.
5. Discussion on the need for a website is ongoing and Mark is investigating means of funding and supporting it.
6. A set of training priorities has been identified, particularly on how to use MapMate.

If you would like to participate in work on the new *Flora*, please contact Mark (72 Michael Cliffe House, Skinner Street, London, EC1R 0WX; Tel.: (+44) 020 7837 1471; E-mail: Lnhs_plant_recorder@hotmail.co.uk).

Mary Clare Sheahan resigned as bryophyte recorder at the end of 2009 and we thank her for all her work during her time in office. Her activities were covered by last year's report. We welcome our new bryophyte recorder, Peter Howarth, who was appointed in July 2010. As a result there has been a brief hiatus in the recorder's work and Peter will provide his first report next year.

Ted Tuddenham reported that the year had been one of active foraying; with many outings planned through the London fungi message board e-group (londonfungi@yahoogroups.co.uk), and three forays were officially listed. A spring foray in the Selborne Society's private reserve at Perivale Wood was well attended although dry weather in the week preceding the foray limited the list for the day. The summer was warm and wet, leading up to a wet autumn, which produced the biggest autumn flush for a decade in mid September to early October. A somewhat drier spell followed which gave way to more rain in time for the Grand Annual Foray around Haringey sites. This took place on Halloween and was attended by about fifty forayers. The edible collection was eaten, with twelve species being served ranging from beef steak fungus to hare's ear. An identification session the following night took the total list to 150 species with five new to the borough.

The last 'urban foray' was represented by a poster presentation at the IMC 9 in Edinburgh during August, presented by Keith Thomas and Ted Tuddenham, which was well received. This is preparatory to a summary of the 25-year update to be prepared for next year's *London Naturalist*.

DAVID BEVAN, *Chairman*, SARAH GRAHAM-BROWN, *Secretary*

ECOLOGY AND ENTOMOLOGY

With Mick Massie as its new chairman, the Section has consolidated and built on past achievements. Among other initiatives, he has started a dialogue process with all recorders to understand how their role may be better supported. Responses have been forthcoming from the majority and it is hoped that new initiatives can be implemented over time to raise member interest and assist all recorders to fulfil their responsibilities.

As newly appointed field meetings secretary, Tristan Bantock organized twenty-seven field trips during the year including one held jointly with Butterfly Conservation. These ranged far and wide and provided an extensive guided tour of the varied habitats of the London region, featuring both entomological and non-entomological subjects for study. In addition, the monthly Bookham Common meetings are now attended by a regular group with entomological interests and so the field calendar is well filled. There can't be another society in Britain with such an extensive and well-attended field programme.

Our indoor meetings secretary, Claudia Watts, has arranged interesting speakers on topics of interest to members in general as well as to entomologists. In January, Mandy Rudd, director of Greenspace Information for Greater London (GiGL), spoke about the work of her organization, explaining the mutual benefits to GiGL and the LNHS. In March, Andy Sands took us on a 'British Safari' to illustrate with his brilliant photographs that a naturalist does not have to go abroad to experience amazing wildlife, and this meeting was enthusiastically received by all who attended. Tristan Bantock, our new recorder of Hemiptera, provided an identification workshop on this order in August where his thorough preparation was well appreciated by those who attended, all of whom came away able to key out most Hemiptera to family level. This meeting can be a model for how those members with knowledge pass on some of their skills and enthusiasm to others, and we will be looking for opportunities to provide similar events for other orders in future. September was the occasion of our annual joint meeting with the British Entomological and Natural History Society. At this year's event Dr Erica McAlister of the Natural History Museum gave the seventeenth Brad Ashby Memorial Lecture with the title 'The Natural History Museum, the Darwin Centre and Diptera' covering the history of the museum with special reference to Diptera. In October, Ray Uffen, basing his talk on the research of the late Michael Majerus, described the up-and-down history of the peppered moth over the past 150 years and its demonstration of natural selection in spite of the objections of creationists.

Following the formal business of the AGM in November, reports from some of the Section's thirteen recorders were integrated into a 'Photographic Review of the Year' with contributions from other members. The images showed some recent invertebrate arrivals or species that are spreading. Edward Milner said that the green spider *Nigma walckenaeri*, that spins a web on ivy leaves, is a London specialist. Ray Uffen reported that the tree bumblebee *Bombus hypnorum* is spreading extensively, nesting in bird boxes and in one case in an abandoned hanging basket. We have not had a Hemiptera recorder for a long time so Tristan Bantock had quite a bit of catching up to do over the past year. Nevertheless he reported a number of species new to London including a ground bug, *Rhyparochronus vulgaris*, found at Rainham Marshes, and *Zygina nivea*, a whitish leafhopper found on white poplar which is probably well established (and at 3 mm may just have been overlooked). *Eremocoris fenestratus* had not been seen for fifty years but was recently found under yew trees in Brentford, probably a new colonist, and possibly originating in Kew Gardens. Other recent arrivals include the red-and-black bug *Arocatus longiceps*, first reported in 2006; it feeds on the seeds of London plane so is abundant in many areas of London on city street trees. The newly arrived and impressive Western conifer seed bug *Leptoglossus occidentalis* was found on a trip to Wimbledon Common. Tristan also observed the ivy bee *Colletes hederae* at Carshalton Station; first seen on the south coast ten years ago, it gathers ivy pollen so it too should soon be widespread here. The formerly very rare Red Data Book 2 beetle *Diaperis boleti* is now also widespread in the London area feeding on the birch polypore fungus. Sarah Barnes reported another recent arrival, the southern bush cricket; with reduced wings, it cannot fly so its future spread will be interesting to follow.

Other images showed some of the excellent wildlife sites in our area visited during the year. In February, Colin Bowlt showed members around Ruislip Wood, one of two National Nature Reserves in our area where coppicing of hornbeam is stimulating changes in the insect fauna. In May there was a trip to

Hartslock Nature Reserve near Goring which is outside our area; this is a small but high-quality site with a chalk slope which yielded several rarities. At Bushy Park in August the attraction was the few species of insect that live exclusively in mistletoe, here growing on hawthorn, and so more accessible. Other trips described included a successful search for reptiles at Hounslow Heath, several rewarding trips to the Tilbury area, wet meadows of south Hertfordshire, Greenford where a number of wetland flies were found, and different stops on the tram to New Addington that revealed a variety of habitats.

Keen naturalists meet every month at Bookham Common on survey days. As part of the 'Photographic Review of the Year', Bookham Common chairman Stuart Cole described some of the finds this year including three species of jewel beetle in a log pile, a wasp beetle and the 8–9 cm giant ichneumon fly *Dolichomytus imperatus*. Paul Wheeler runs a light trap the night before many of the meetings, staying on guard all night to remove hornets that otherwise cause havoc among the trapped moths.

Once again the Section represented the Society at the Amateur Entomologists' Society Exhibition, signing up two members and selling books and journals as well as making the work of the LNHS known to a wider public.

We would welcome members willing to join us to carry on the work of the Section and the Society.

MICK MASSIE, *Chairman*, CATHERINE SCHMITT, *Secretary*

ORNITHOLOGY — LONDON BIRD CLUB

There were several changes to the London Bird Club during the year, including a change of chairman: David Lindo stood down in the autumn and David Darrell-Lambert returned. Our thanks and acknowledgements go to David Lindo for the contribution he made during his time in the chair. He developed several innovations: the launch of the London Bird Club, the change of logo, visits to Tower 42, and changing the *Ornithological Bulletin*. Kat Duke has taken over as the new indoor meetings secretary.

It has been a very successful year for our field meetings. Pete Lambert organized outings almost every weekend, which is something that makes the London Bird Club unique. These aim to introduce visitors to a site and show them how and where they can locate birds there. We don't generally expect to see rare birds although we have turned up some unusual species during our outings. An example of this was a meadow pipit over Tooting Common in March and a cuckoo at Walthamstow Reservoirs in June (the only one recorded there in 2010).

Rare birds have been recorded, the highlight being a pectoral sandpiper at Beddington in September. On that day there were ten species of waders including ruff and knot, both of which are hard to find in London.

This year we returned to Staines Reservoirs where smew was recorded, a species that has become rarer to London with the recent mild winters. Just outside the LNHS recording area in Essex, Two Tree Island was the only site where corn bunting was seen. This site holds a spectacular wader roost with masses of knots and oystercatchers and, in addition, about sixty avocets were seen and three greenshanks. We must not miss out Inner London where our walk produced red-crested pochards and tawny owls, the latter hard to locate during the day. The August walk at Rainham Marshes RSPB reserve produced a possible record count for any day trip, eighty-six species, which included four species of tern (little possibly being the most impressive). Our last walk of the year, at Kew Gardens, was unfortunately cut short by a blizzard! But they did manage to see redwings and nuthatch, plus several wildfowl, before snow stopped play. This represents only a fraction of the total species recorded and the highlights and demonstrates the wide diversity of the species present in and around London. Our grateful thanks go to all the leaders of the walks: without them none of these would have happened.

Neil Anderson continues to organize coach outings. The January visit to Holkham proceeded with some great birding including woodcock in the open, bittern, snow buntings and a mix of seabirds and wildfowl. Two summer programme meetings went ahead and both were successful. At Fingringhoe we heard — and some saw — nightingales. There were also turtle dove and hobby, and everyone had the thrill of seeing three adders together in a mating ball. On most of our spring visits to Dungeness we have managed to coincide with a good rarity — and this was no exception. We saw whiskered tern, which was a one-day bird there. One couple also saw one of the purple herons that went on to be the first UK breeding record of this species. A good number of harbour porpoises, a flock of six wood sandpipers, yellow wagtails and black redstart added to the many fine species recorded on this occasion.

The final outing of the year was a rescheduled visit to Hickling Broad/Stubb Mill, which had to be cancelled last year due to heavy snow and ice. It was nearly a case of déjà-vu as once again severe winter weather was affecting much of the country. The route to Norfolk appeared less badly hit and a last-minute decision was made to run the trip. Due to the weather about a third of those who had booked opted to stay at home, though it was viable with these bookings. Marsh harriers were noted in good numbers. Some fog spoiled the experience at the raptor roost though a male hen harrier was briefly seen along with the marsh harriers, a kestrel and a sparrowhawk. We all heard cranes and some of us had a blurry view of one, though a cock yellowhammer was more obliging. It was a year of ups and downs: there were some well-supported trips and one that wasn't. Those that ran produced a diverse range of wildlife.

Early in the year, David Darrell-Lambert once more stepped into the breach and gave talks on identifying birdcalls and on photographing wildlife. We had a talk on using technology, such as your iPhone or iPad, to identify birds and bird calls. There was a talk on the progress of the BTO *Atlas*, given by our organizers, Richard Arnold and Ian Woodward. At the AGM in November, Russell Spencer gave a talk on bird photography.

The Recorders' Committee and the Rarities Committee both saw significant changes during the year with the arrival of new Surrey recorder, Nick Tanner replacing Steve Spooner, one of the longest-serving recorders. Our thanks go to Steve for his dedication and efforts over the last seventeen years. Steve has also been the database manager, dealing with up to seventy-five thousand records per year. Andrew Self stood down as editor of the *London Bird Report* and a new structure was put in place. An editorial board chaired by Pete Lambert was founded, to speed up the production of the *LBR*. Thanks go to Andrew Self for his devotion and all the work he undertook as editor.

We attended Lee Valley Countryside Live in September. Mike Trier organized the stand. We had good weather, a reasonable number of visitors and we sold some of our merchandise. However, we felt that better publicity and better positioning at the fair could have made our day even more successful.

The Committee look forward to hearing from members who want to make suggestions to improve the work of the London Bird Club. We hope you will take the opportunity to promote the Club, particularly to younger birdwatchers. We have a lot to offer — including the fact that the LNHS covers plants, insects and all aspects of natural history. We also hope you will suggest topics for our indoor meetings and come along on the weekly field trips, where you will find some of London's hidden gems with the chance of seeing some wonderful birds.

DAVID DARRELL-LAMBERT, *Chairman* (david@birdbrainuk.com),
ANGELA LINNELL, *Committee Secretary* (angela.linnell@phonecoop.coop)

Book review

Mosses and liverworts of Britain and Ireland: a field guide. Edited by Ian Atherton, Sam Bosanquet and Mark Lawley. British Bryological Society, 2010. vi, 848 pp. Softback, £24.95. ISBN 978 0 9561310 1 0.

There has long been a need for a good up-to-date field guide for mosses and liverworts. Watson's *British Mosses and Liverworts* 3rd edition is good on descriptions and pictures but its key relies in part on microscopic features, and of course nomenclature has been much changed since it was published. The gap has now been filled by this new guide, produced by a team of bryological experts. It was available online in draft form for some time before it was published, and we have had the opportunity to use it the field for a season, so it has already had time to prove its value.

The book starts with a 'gallery' of line drawings showing some typical life forms, which could perhaps be especially useful for those new to bryology; the drawings are clear and informative. There then follows a colour-coded dichotomous key to a large proportion of the species of the British bryoflora, using only characters which can be seen in the field; many of the couplets have useful line drawings to illustrate the characters used. It is deliberately written in simple, non-technical language.

But of course the main part of the book consists of the species photographs and accounts, which are provided for about three-quarters of the flora. Each species, or group of related species, has a distribution map and a photograph — often more than one — highlighting the essential identifying features. The species accounts give a detailed description, a very useful guide to other species which it could be confused with, and a note of habitat requirements, and some have line drawings to illustrate particular points such as leaf shape; it would be good to see more of these. At the end there are lists, similar to those found in Watson's book, of thirty-four different habitats and the species typically found in them.

A feature which is so useful I'm surprised it doesn't appear more often in botanical books, is the cross-reference to the appropriate couplet in the key, which is given for most of the species. This makes it possible to check out the characters which separate the species in question from other similar species.

In the field I think the only disadvantage of the book is its weight; this is of course necessitated by the good-quality paper needed for the mostly excellent colour pictures, and is a small price to pay for its usefulness.

The whole provides a very attractive and user-friendly book, which will bring a whole new audience to the study of these delightful, intricate, maddening organisms. Non-bryological friends of mine have already told me it has done much to take away the alarm inspired by mosses and liverworts in the field. It has been a collaborative exercise in publishing, with input by many members of the British Bryological Society, and it would be hard to think of a better and more educational undertaking by the Society. It is reasonably priced, especially considering it is in full colour, and I gather that sales have deservedly exceeded expectations; it is in fact ongoing — BBS members are currently being asked to comment on individual pages with a view to possible amendments in future editions.

The editors express the hope that this guide will bring many new enthusiasts to the study of bryophytes, and in view of its success it seems as though their wish may already be coming true.

MARY CLARE SHEAHAN

Early London botanists: '. . . in the fieldes aboute London, plentuously . . .'

JOHN EDGINGTON
19 Mecklenburgh Square, London WC1N 2AD

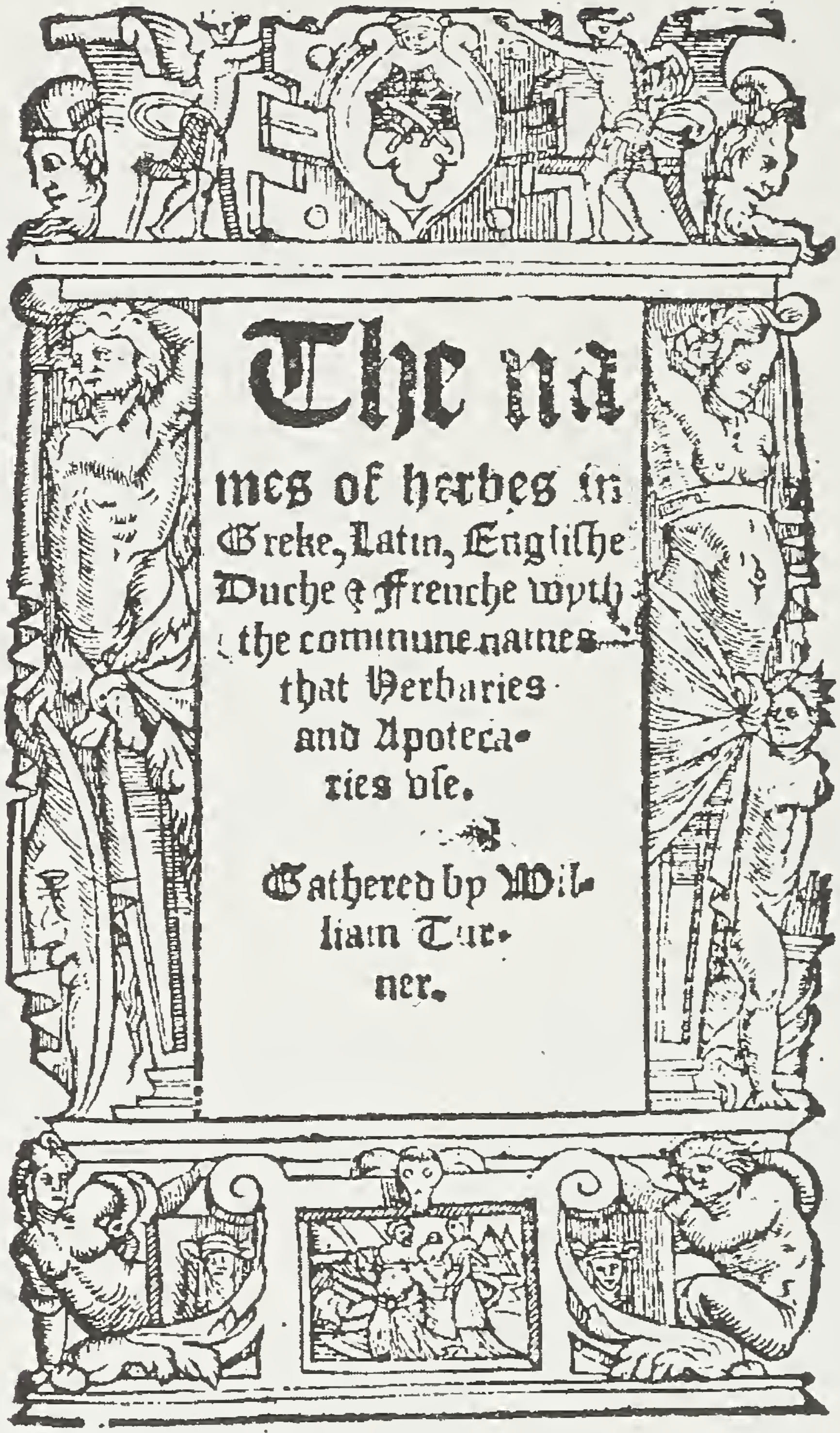
Presidential Address delivered at the Annual General Meeting on 15 December 2010

A fascinating aspect of natural history is the story of discoveries of living organisms, sometimes 'new to science', more often the first recorded occurrence in a country or district. The time and place of the first records of British plants (about 1,500 species, if recent introductions, and the many so-called 'microspecies' of plants like brambles and hawkweeds, are excluded) are well documented; perhaps surprisingly, more than 180 of these were first found in the Society's recording area around London. This gives some indication of the richness of London's flora a few centuries ago, and of the attention it received from residents and visitors alike. Here I give a short account of some of the people who botanized in London, the places they explored, and the plants they found there. I say something about what has happened to these places and their plants, and end with some comments about a distinctive London plant of which the early botanists knew nothing but which has dramatically changed the character of the city.

As doctors now gravitate towards Harley Street, so the physicians and apothecaries of Tudor and Elizabethan times were attracted to commercial London and its sister city, Westminster with its royal court. These men were our earliest botanists, and the first of them was the physician and theologian William Turner (*c.*1508–1568). Turner, born in Morpeth, was a friend of Latimer and Ridley and like them a man of fiercely protestant views, attested by books such as *The huntyng and fyndyng out of the Romyshe foxe* and *The huntyng of the Romyshe Wolfe* — the allusion is to Stephen Gardner, Bishop of Winchester — but he escaped their dreadful fate. However his writings were anathema to Henry VIII and Turner spent many years in exile on the Continent where he extended his knowledge of plants.

He returned to England after the king's death in 1547, as physician to Lord Protector Somerset at Syon, Isleworth. Turner's house was across the river in the manor of Sheen (renamed Richmond by Henry VII, though Turner retained the old name). In *The names of herbes* (1548: Figure 1) and the *Herball* (1551–1568, the last part published after he returned from a second exile under Mary) Turner gave the first British records of seventeen plants around London, mostly from Syon and Sheen, including *Hyacinthoides non-scripta* bluebell of which he wrote 'The comune Hyacinthus is muche in Englande aboute Syen and Shene . . .' (Figure 2). Here he saw such familiar plants as *Sherardia arvensis* field madder, *Hypericum tetrapterum* square-stalked St John's wort, *Clinopodium vulgare* wild basil, *Plantago coronopus* stag's-horn plantain and *Onopordum acanthium* cotton thistle (Figure 3), while he observed that *Tragopogon pratensis* goat's-beard 'groweth in the fieldes aboute London, plentuously'. All these plants still do, though others, including *Chamaemelum nobile* chamomile and *Spiranthes spiralis* autumn ladies' tresses, have declined or been lost altogether.

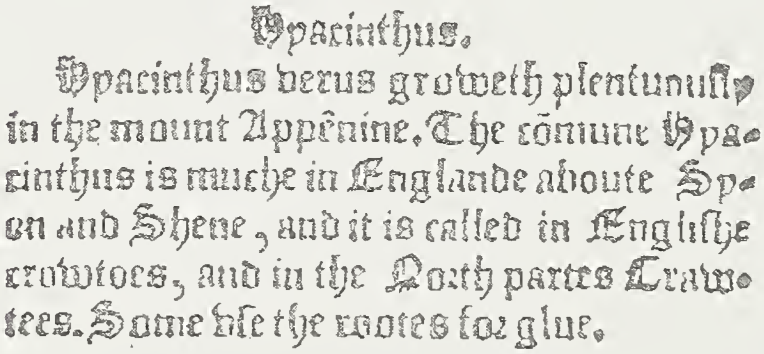
From Hounslow Heath, Turner gave us the first British record of *Mentha pulegium* pennyroyal, a plant of pondsides where it is spread and maintained by



The na
mes of herbes in
Greke, Latin, Engliſhe
Duche & Frenche wyth
the commune names
that Herbaries
and Apoteca-
ries vſe.

Gathered by Wil-
liam Tur-
ner.

FIGURE 1. William Turner's *The names of herbes* (1548).



Hyacinthus.

Hyacinthus verus groweth plentuuſly in the mount Appẽnine. The cõmune Hyacinthus is muche in Englande aboute Syon and Shene, and it is called in Engliſhe crowtoes, and in the North partes Crawtees. Some vſe the rootes for glue.

FIGURE 2. Turner's entry for *Hyacinth* (bluebell), from *The names of herbes*.

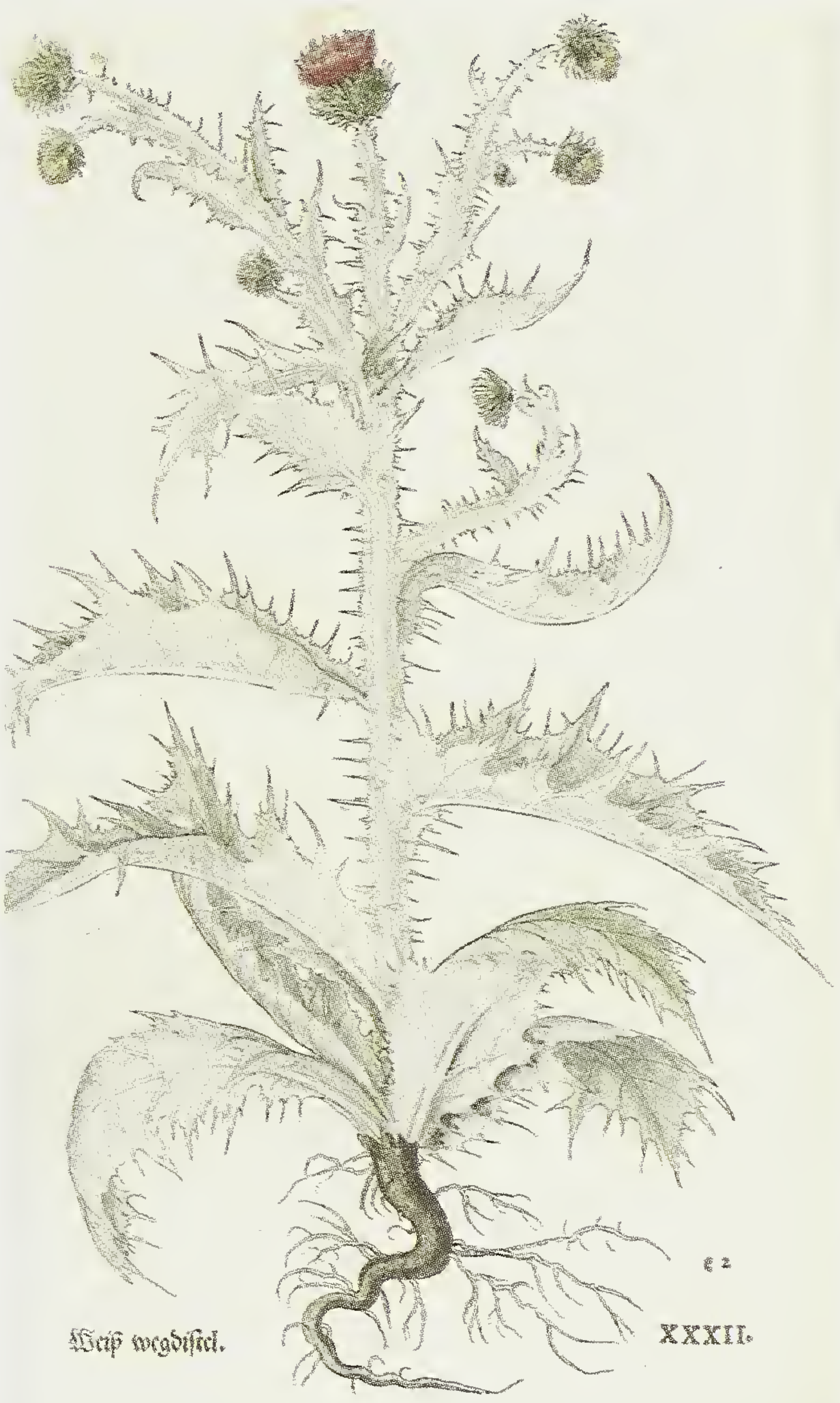


FIGURE 3. Cotton thistle, from Leonhart Fuchs' *New Kreüterbuch* (1543). Turner met Fuchs in Basle and used his woodcuts to illustrate his own *Herball*.

cattle as they trample and manure the ground. Though pennyroyal has almost disappeared from London there is a flourishing population by the lake in Regent's Park, where the place of cattle is taken by Canada geese which perform the same function. Turner would have enjoyed this example of involuntary habitat re-creation for he was an all-round naturalist; besides his contributions to botany he is credited with the first British records of thirty-seven species of birds. No portrait of him is known, and his funeral tablet in St Olave's Crutched Friars, near his home for the last years of his life, did not survive the Second World War.

Another adherent of the reformed church, the great Flemish botanist Charles de l'Ecluse (1526–1609), commonly known as Clusius, visited England on two occasions but seems not to have met Turner. To Clusius we owe the first records of *Salvia verbenaca* wild clary and *Anthemis arvensis* corn chamomile in 1579, and *Typha angustifolia* lesser bulrush 'in a muddy ditch at Tyburn near the cemetery where criminals hanged there are buried' in 1581, though he did not publish these until 1601.

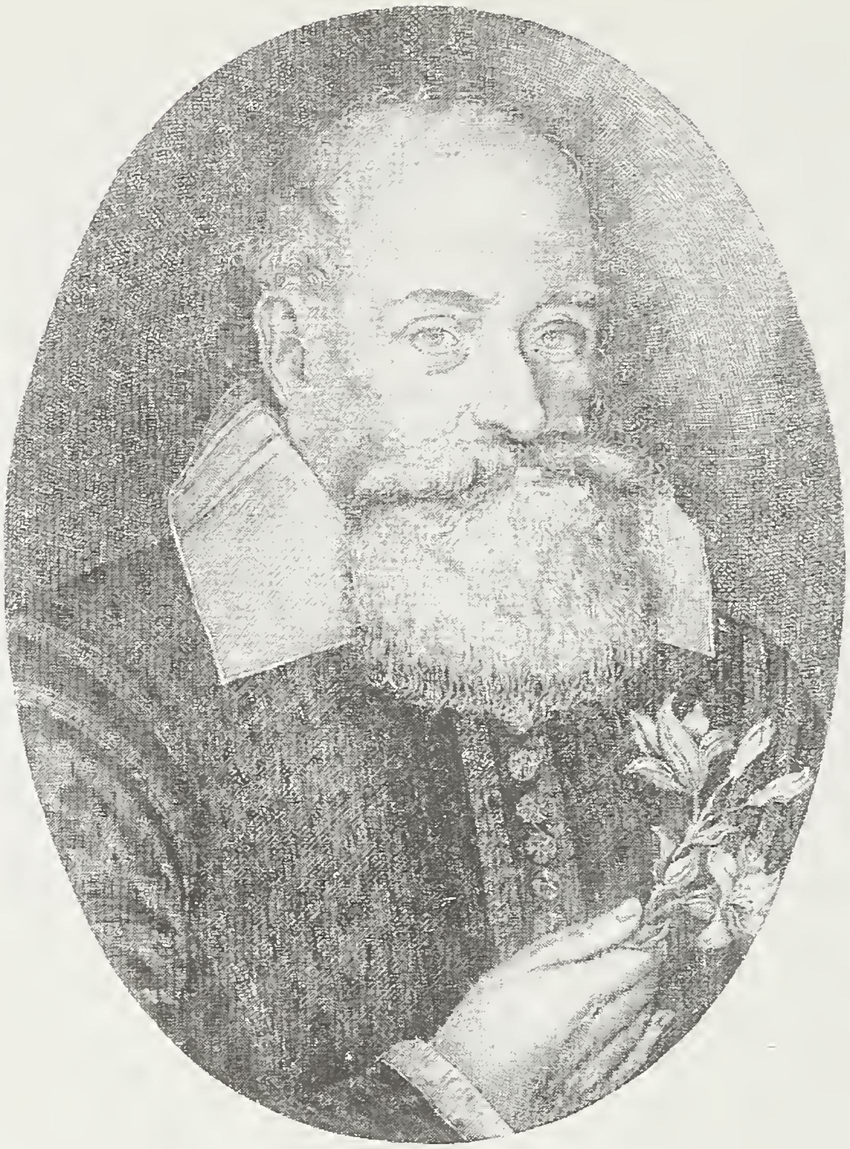


FIGURE 4. Mathias de L'Obel, holding a Madonna lily *Lilium candidum*.

Clusius's compatriot, the physician Mathias de l'Obel (1538–1616: Figure 4), corresponded with Turner during the latter's exile and about 1567 came to England for the first time, travelling up the Thames on his way to Bristol. At Greenwich he discovered *Ornithopus perpusillus* bird's-foot, *Aira caryophyllea* silver hair-grass and *Botrychium lunaria* moonwort in grassland by 'the King's House, overlooking the Thames'. Returning to the Low Countries, l'Obel became court physician to William the Silent of Orange until, on the latter's assassination in 1584, he returned to England where as Botanist to James I he lived peaceably in Highgate for the rest of his life. There he discovered *Equisetum sylvaticum* wood horsetail and *Gnaphalium sylvaticum* heath cudweed; both are gone. Near Hackney he found one of our commonest grasses, *Cynosurus cristatus* crested dog's-tail, and at Ratcliffe, near the Thames, *Phalaris arundinacea* reed canary-grass. His other finds in London included *Scutellaria galericulata* skullcap, *Bidens cernua* nodding bur-marigold, *Catabrosis aquatica* whorl-grass, now very rare in the district, and, in water meadows at St Mary Cray, *Epipactis palustris* marsh helleborine, now extinct in London. In our area alone, l'Obel found sixteen plants new to Britain.

He and Turner lived in what was countryside. Their successors lived in a small but densely crowded city (Figure 5) whose population grew from 100,000 at Elizabeth's accession, to 250,000 at her death. A few suburbs were beginning to encroach on the surrounding fields and marshes but within the 'bars', or city limits, there were still plenty of gardens, and gardeners, one of whom was another physician, John Gerard (1545–1612: Figure 6).

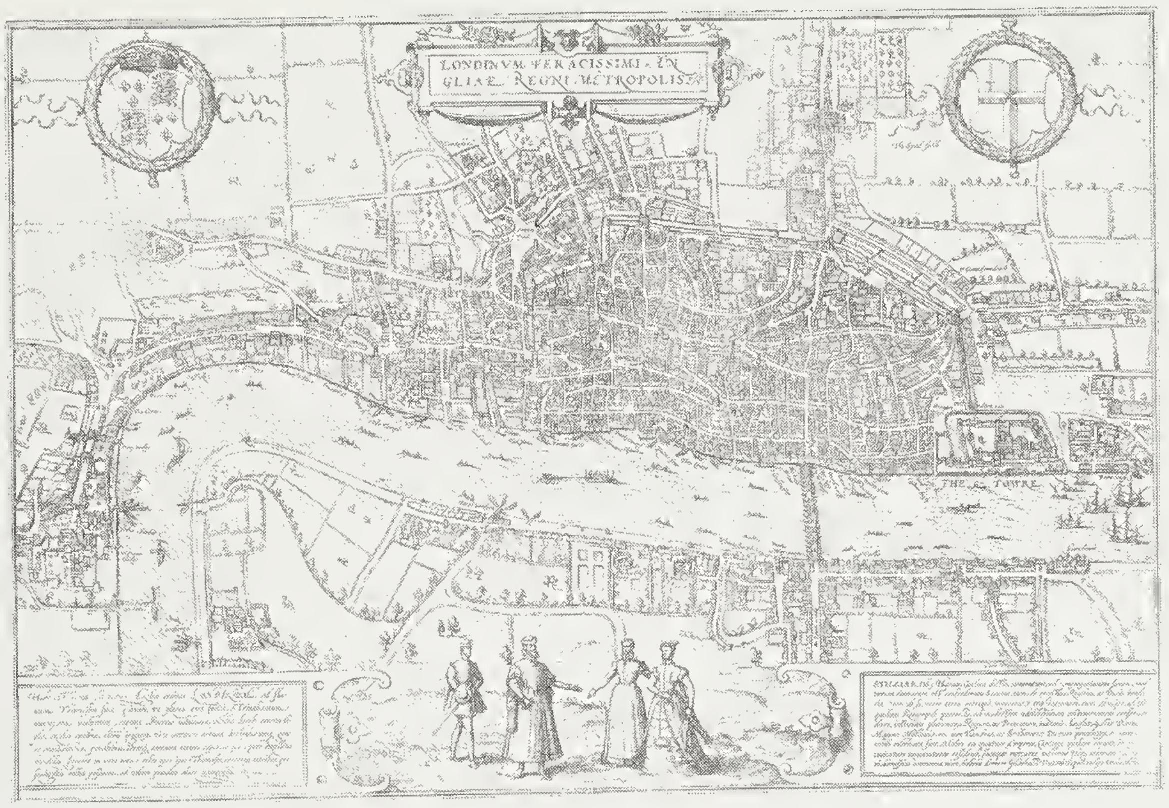


FIGURE 5. Braun and Hogenberg's map of London, *c.*1560.

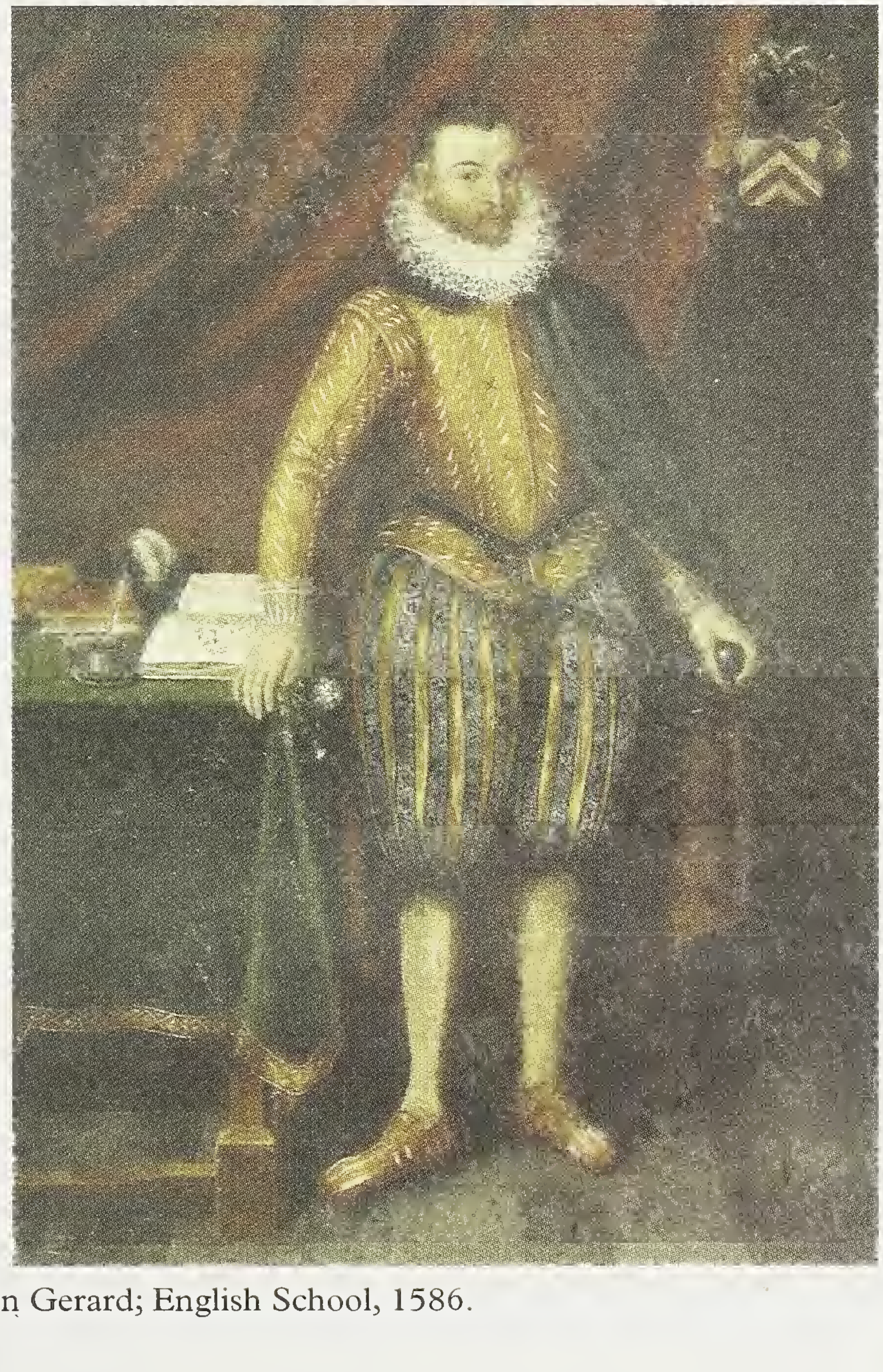


FIGURE 6. John Gerard; English School, 1586.

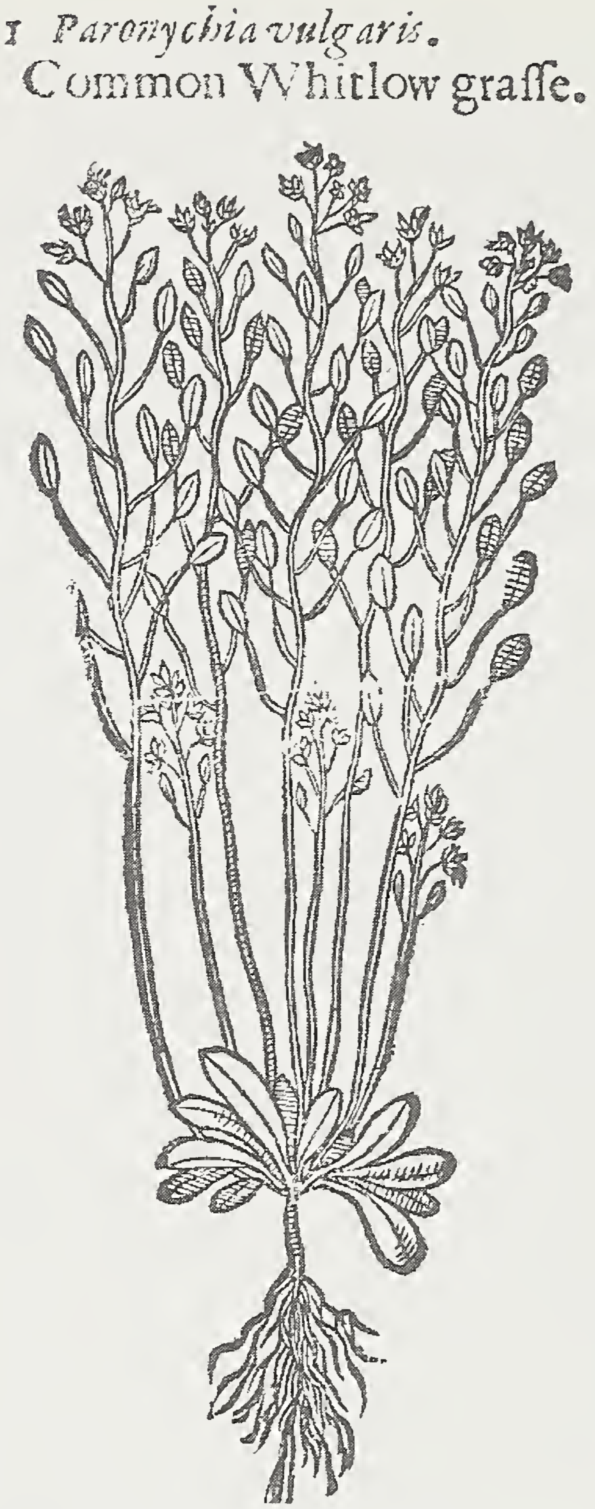

1 Paronychia vulgaris.
Common Whitlow graſſe.

FIGURE 7. Common whitlow-grass *Erophila verna*, from Gerard's *Herball* (1597).

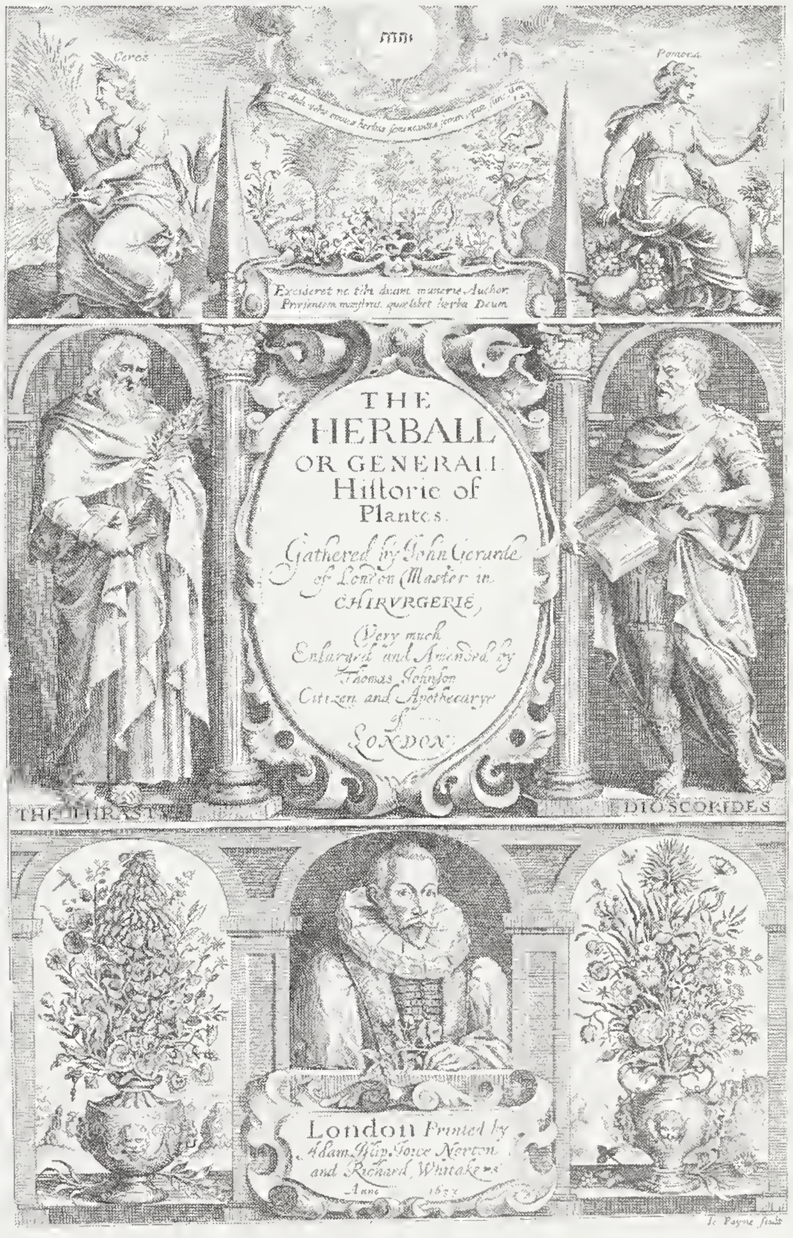
Gerard's *Herball* of 1597 was in large part plagiarized from Priest's translation of the *Pemptades* of another Flemish physician and botanist, Rembert Dodoens; it is inaccurate and unreliable, but valuable for the information it gives about where plants grew, particularly in London. Gerard's garden was in Fetter Lane. Nearby he found *Salvia verbenaca* (previously recorded by Clusius, though Gerard was not to know this) 'in the fieldes of Holburne neere unto Graies Inne', and in Chancery Lane he saw *Erophila verna* common whitlow-grass (Figure 7) and *Saxifraga tridactylites* rue-leaved saxifrage growing on the walls of the town house of Henry Wriothesley, third Earl of Southampton (Shakespeare's patron and, some think, the 'onlie begetter' of his Sonnets). Both plants were abundant this year (2010) in the Post Office car park at Mount Pleasant, a few hundred metres north of Chancery Lane; but wild clary is almost gone from London.

Just outside the City wall, Gerard found *Ophioglossum vulgatum* adder's-tongue fern 'in a meadow neere the preaching Spittle'. This was a popular open-air pulpit, the equivalent of Speaker's Corner, in the churchyard of St Mary, Spitalfields; the adjacent meadows were places for practicing archery and musket-shooting. He discovered *Lamiastrum galeobdolon* yellow archangel 'under the hedge as you go from the village of Hampstead to the Church'. On Hampstead Heath itself Gerard found orchids including what was probably *Dactylorhiza fuchsii* common spotted orchid, as well as *Serratula tinctoria* saw-wort, *Convallaria majalis* lily-of-the-valley, *Melampyrum pratense* common cow-wheat, 'among the juniper bushes and bilberry bushes', and many others. By 'a village called Edmonton' he saw *Myosuris minimus* mouse-ear, a rare casual now which reappeared briefly in Hyde Park about twenty years ago, and *Turritis glabra* tower mustard. After apparently disappearing from London this unremarkable but very rare plant (sometimes called mustard, sometimes cress) was rediscovered in 1987 at Stain Hill Reservoir, Hampton; it is one of three plants, with mistletoe and black poplar, singled out for special conservation measures by the London Biodiversity Partnership.

South of the Thames, opposite Blackfriars, was a manor house known as Paris Garden (there is a street of this name in Southwark) adjoining a poorly drained area known as St George's Fields where, amongst other plants including *Luzula campestris* field wood-rush and *Oenanthe fistulosa* tubular water-dropwort, Gerard discovered *Hottonia palustris* water violet. 'I have not found such plenty of it', he wrote, 'as in the water ditches adjoining to St George his fielde neere London'. The nearest it now grows to London is Shortwood Common, Staines.

Marshy ground stretched all along the south bank of the Thames from Bermondsey in the east, where Gerard discovered *Lemna trisulca* ivy-leaved duckweed, to Lambeth in the west, where he found *Stachys palustris* marsh woundwort and *Lythrum salicaria* purple-loosestrife 'under the Bishops house wall'. This of course is Lambeth Palace. All three plants are still quite common by waterways in London, but the *Thalictrum flavum* common meadow-rue that he saw on ditch sides near 'Kentish street' (Old Kent Road) has almost disappeared from our district.

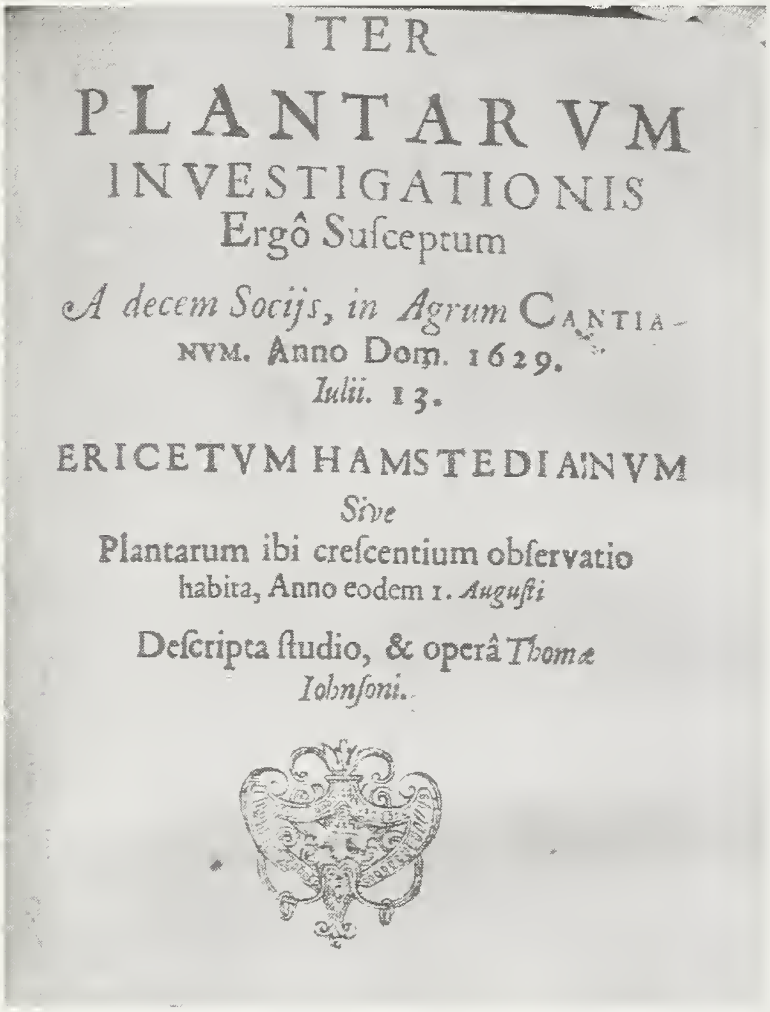
Gerard recorded 182 plants for the first time in Britain, forty-four of these in London, but he made many errors such as matching the wrong illustrations to the descriptions. These were corrected, and a great many more accounts added, by Thomas Johnson (*c.*1604–1644), an apothecary who died fighting for the Royalists in the Civil War. He had a garden in Snow Hill, a few hundred yards from Gerard's, and published his 'very much enlarged and amended' edition of Gerard's *Herball* in 1633 (Figure 8). It included 170 new records, including twenty-six from London. Outstanding among these is John Goodyer's discovery of *Damasonium alisma* starfruit on Hounslow Heath on 30 July 1618. It survives in


THE
HERBALL
OR GENERALL
Hiſtorie of
Plantes.
Gathered by John Gerarde
of London Master in
CHIRVRGERIE
Very much
Enlarged and Amended by
Thomas Iohnſon
Citizen and Apothecarye
of
LONDON.

London Printed by
Adam Islip Joice Norton
and Richard Whitakers
Anno 1633

FIGURE 8. Thomas Johnson's edition of Gerard's *Herball* (1633).

Britain only through energetic conservation measures. And on 16 September 1625 Goodyer found another rare plant, *Cicuta virosa* cowbane, ‘by Moreparke, and at Denham in Hertfordshire [*sic*] in standinge water’. Johnson himself found *Anchusa arvensis* bugloss ‘upon the drie ditch bankes about Pickadilla’, not where we might find this arable weed today, and *Potamogeton perfoliatus* perfoliate pondweed near Tottenham. He led his friends and apprentices on many ‘simpling’ excursions in search of herbs, the earliest being those to Kent, where he found *Himantoglossum hircinum* lizard orchid ‘nigh the highway between Crayford and Dartford’. But we in London remember him best for his visits to Hampstead Heath.



ITER
PLANTARVM
INVESTIGATIONIS
Ergô Suſceptum
A decem Socijs, in Agrum CANTIANVM. Anno Dom. 1629.
Iulii. 13.
ERICETVM HAMSTEDIANVM
Sive
Plantarum ibi creſcentium obſervatio
habita, Anno eodem 1. *Auguſti*
Deſcripta ſtudio, & operâ *Thomæ*
Iohnſoni.

FIGURE 9. Johnson’s *Iter plantarum* (1629).

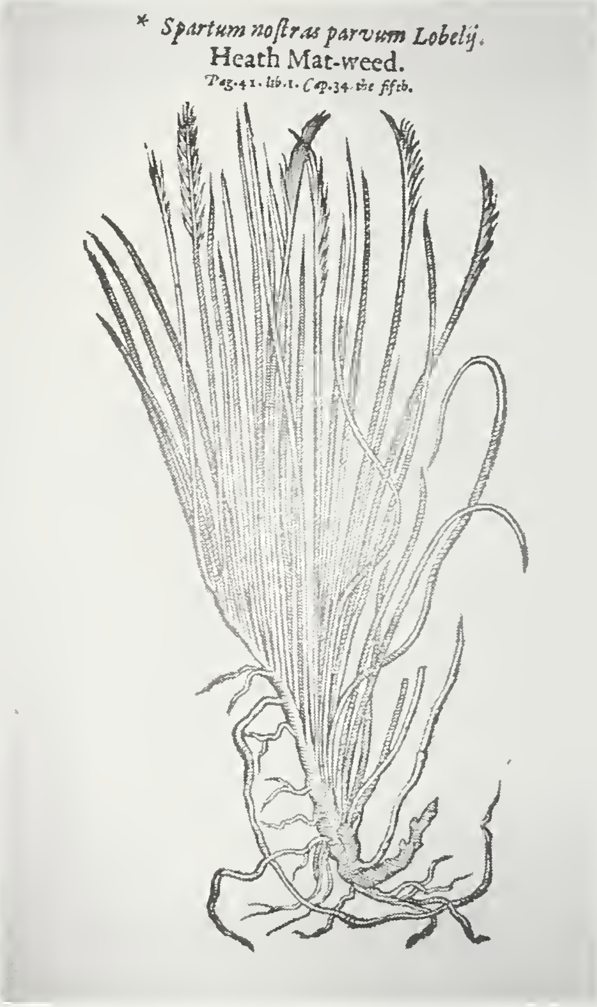

* Spartum noſtras parvum Lobelij.
Heath Mat-weed.
Pag.41. lib.1. Cap.34. the fifth.

FIGURE 10. Mat-grass *Nardus stricta*.

Seventeen of Johnson’s discoveries were on or close to the Heath — then a wild and rather dangerous place, dominating the northern skyline but of no economic value and rarely visited by the citizens. His accounts of the plants growing around Hampstead, *Ericetum Hampstedeanum* (in Johnson 1629: Figure 9) and *Enumeratio plantarum in ericeto Hamstediano* (in Johnson 1632) constitute Britain’s first local flora. Among his additions to the British list were *Ranunculus sceleratus* celery-leaved buttercup, *Stellaria graminea* lesser stitchwort, *Medicago arabica* spotted medick, *Juncus acutiflorus* sharp-flowered rush, *Carex caryophyllea* spring sedge and *Matricaria chamomilla* scented mayweed from the Heath itself, the lovely little *Lathyris nissolia* grass vetchling and *Lactuca serriola* prickly lettuce ‘betweene London and Pancridge [St Pancras Old] Church’, and the first localized records, surprisingly late, of *Salix viminalis* osier and *Geranium robertianum* herb-Robert. He is also thought to have seen *Nardus stricta* mat grass, the last entry in his edition of Gerard’s *Herball* (Figure 10), a typical heathland species, on the Heath in 1629, but his other writings show that he first saw this grass on Chislehurst Common in 1633, and the identity of the plant he saw at Hampstead is uncertain (Edgington 2010).

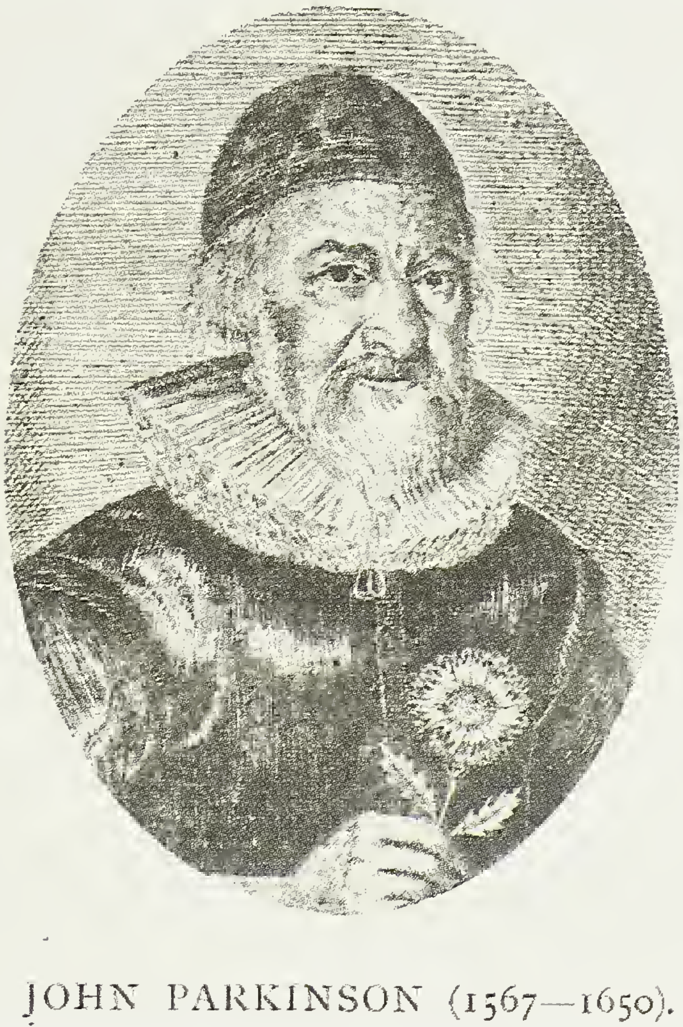
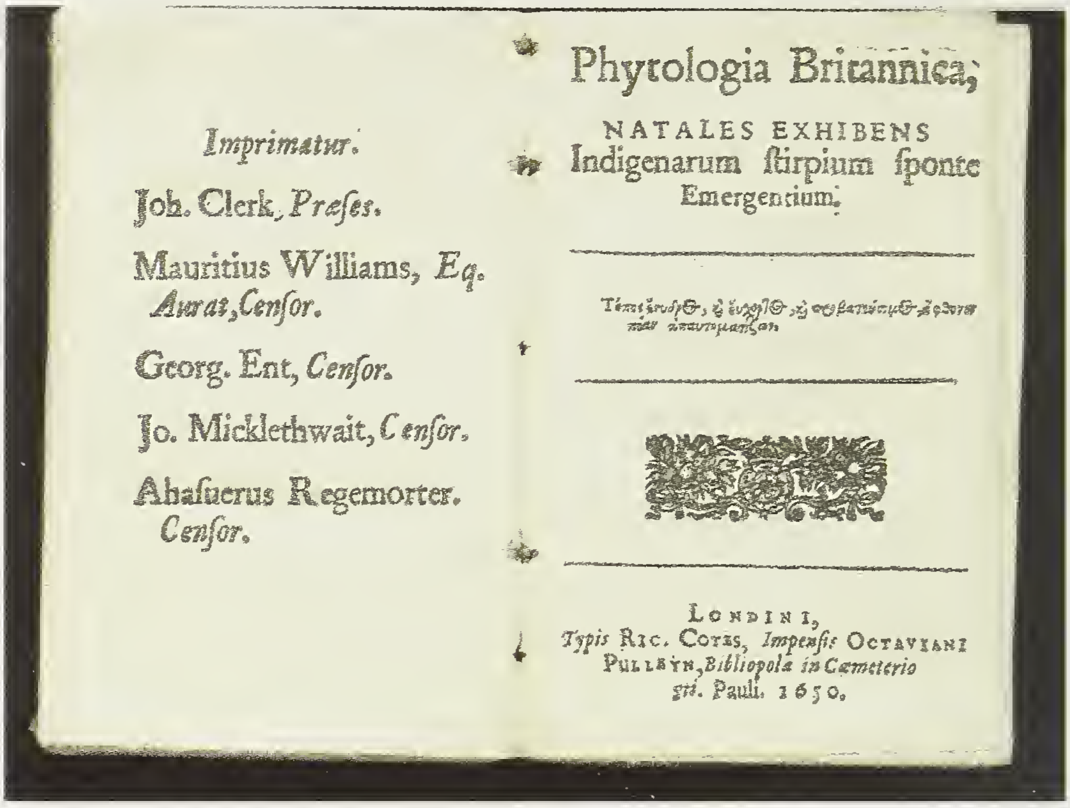


FIGURE 11. John Parkinson, holding a sunflower.

Johnson's edition of Gerard's *Herball* somewhat overshadowed the more leisurely efforts of another apothecary and gardener, John Parkinson (1567–1650: Figure 11), an older man whose *Theatrum Botanicum* appeared in 1640. More a gardener than a botanist, Parkinson had earlier published a garden manual, *Paradisi in sole* (a pun on his name, when translated as 'Of park-in-sun'). Long Acre, where he had his garden, was then a desirable suburb between the City and Westminster. Parkinson's pioneer records from London are few but interesting; he found *Brassica rapa* turnip, for example, 'going from Shorditch by Bednal Greene to Hackney'. You can see similar-looking plants of turnip's close relative, *Brassica napus* oil-seed rape, in the same places today. *Scilla autumnalis* autumn squill, 'at the hither end of Chelsey before you come to the King's Barge-house' is sadly no longer there, but a plant that Parkinson saw in the north of our district most certainly is; at Hatfield he recorded *Cymbalaria muralis* ivy-leaved toadflax that had evidently escaped from a garden. Now it is ubiquitous in London's streets to which, like many other introductions, it seems better suited than our native plants.

The *Phytologia Britannica* (1650) of William How (1619–1656) was the first book devoted exclusively to the plants of Britain (Figure 12). How was yet another physician, practicing in St Laurence Lane and later in Milk Street, Cheapside. He copied shamelessly from Johnson (perhaps one reason why *Phytologia* was published anonymously) and rather few of his records are first-hand. From London they include *Potamogeton pusillus* lesser pondweed 'between Carleton [Charlton] and Wulwich' and a species of *Petrorhagia* (proliferous, or perhaps Childing, pink) 'in the grounds 'twixt Hampton-Court and Tuddington'. As Kent (1975) wrote, this plant is 'long extinct if ever it occurred'. These printed records are perhaps less interesting than the long list written by How in his own copy of *Phytologia*, now at Magdalen College, Oxford. These include *Schoenoplectus triqueter* triangular club-rush 'at the

Horse-Ferry at Westminster' and *Sisymbrium irio* London rocket (Figure 13) which How notes was seen by John Goodyer 'near White Chappel east from Aldgate', in 1642 or earlier.



Imprimatur.

Joh. Clerk, *Præſes.*

Mauritius Williams, *Eq. Aurat, Cenſor.*

Georg. Ent, *Cenſor.*

Jo. Micklethwait, *Cenſor.*

Ahaſuerus Regemorter. *Cenſor.*

Phytologia Britannica;

NATALES EXHIBENS

Indigenarum ſtirpium ſponte

Emergentium.

LONDINI,

Typis RIC. COTES, *Impenſis* OCTAVIANI

PULLEYN, *Bibliopolæ in Cæmeterio*

sti. Pauli. 1650.

FIGURE 12. William How's *Phytologia Britannica*, published anonymously in 1650.

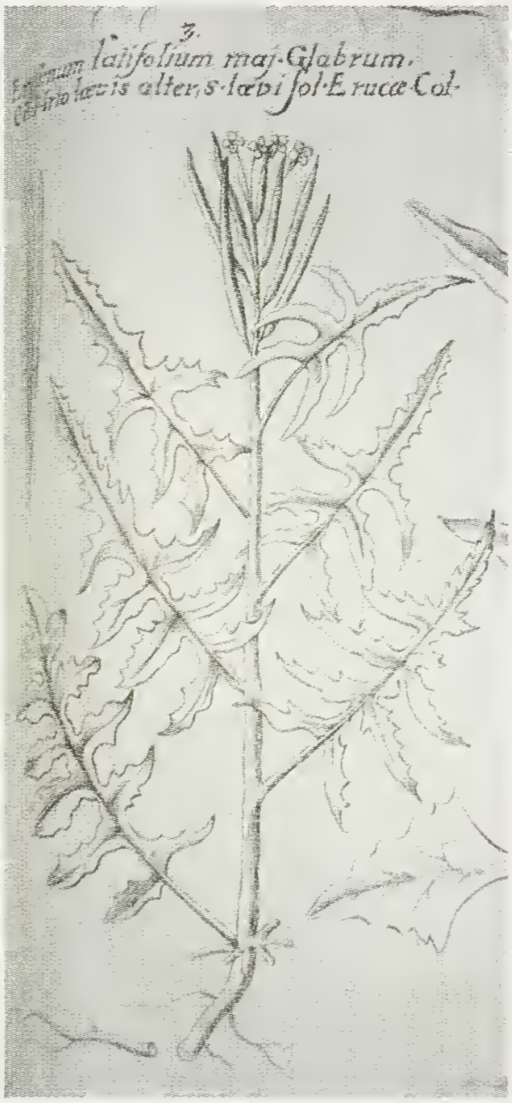
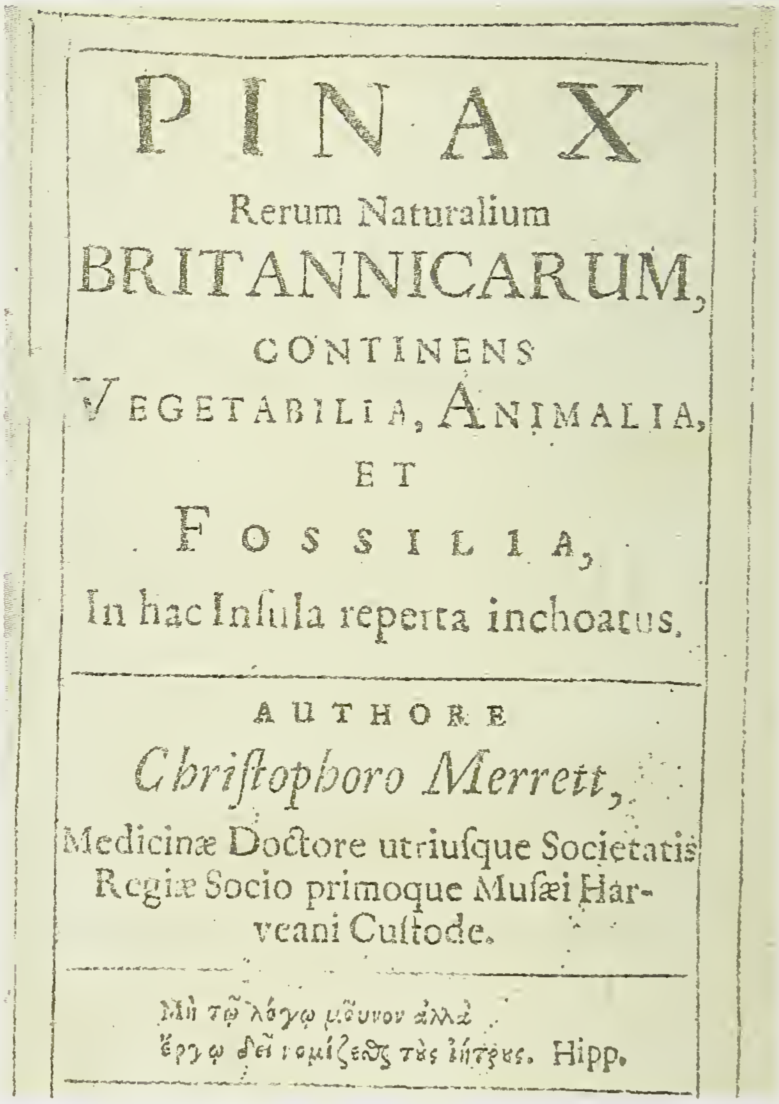

3.
latifolium maj. Glabrum.
irio lævis alter, s. lævi fol. Erucæ Col.

FIGURE 13. London rocket *Sisymbrium irio*, from Morison's *Plantarum historiae* (1690).



PINAX

Rerum Naturalium

BRITANNICARUM,

CONTINENS

VEGETABILIA, ANIMALIA,

ET

FOSSILIA,

In hac Inſula reperta inchoatus.

AUTHORE

Chriſtophoro Merrett,

Medicinæ Doctore utriuſque Societatis

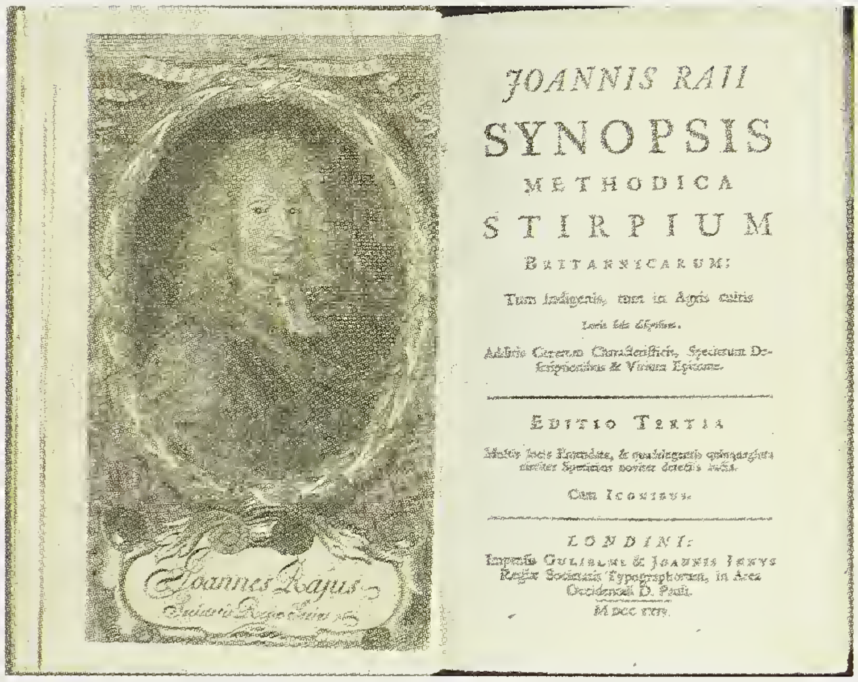
Regiæ Socio primoque Muſæi Har-

veani Cuſtode.

Μὴ τῷ λόγῳ μοῦνον ἀλλὰ

ἔργῳ δεῖ νομίζεσθαι τοὺς ἰητρούς. Hipp.

FIGURE 14. Christopher Merrett's *Pinax* (1666), from the reprint of 1667.



Joannes Rajus

JOANNIS RAII
SYNOPSIS
METHODICA
STIRPIUM
BRITANNICARUM;

EDITIO TERTIA

Cum Iconibus.

LONDINI:

FIGURE 15. Third edition of John Ray's *Synopsis methodica stirpium Britannicarum*, edited by John Jacob Dillenius (1724).

A few years later (1666) another physician, Christopher Merrett (1614–1695) of Hatton Garden, Curator of the Museum and Library of the physiologist William Harvey and a founder member of the Royal Society, compiled a natural history of Britain, the *Pinax* (meaning a register or ordered list: Figure 14). Commentators have been dismissive of Merrett's work, as inferior to his great contemporary John Ray, but his was the most complete record of British wildlife — animal, vegetable and mineral (fossils) — at the time. The fifteen new plants from London recorded by Merrett (many actually discovered by his unacknowledged assistant Thomas Willisell) range from some whose saltmarsh habitat has been lost, together with its special plants such as *Lathyrus palustris* marsh pea, 'in Peckham Field . . . in a squalid watery place' according to Ray, and *Sonchus palustris* marsh sow-thistle 'betwixt Woolwich and Greenwich', through interesting discoveries such as the first record of *Mespilus germanica* medlar in the wild, in 'hedges betwixt Hampstead Heath and Highgate', to abundant and familiar weedy species such as *Arabidopsis thaliana* thale cress, *Cerastium glomeratum* sticky mouse-ear and *Aegopodium podagraria* ground elder, goutweed that still grow where Merrett located them in Marylebone, Hyde Park and Moorfields respectively.

John Ray (1627–1705) was arguably England's greatest naturalist. His *Synopsis methodica stirpium Britannicarum*, best known in its third, posthumous, edition of 1724, edited by John Jacob Dillenius (Figure 15), was the essential flora for British botanists for over a century. The first records from London, most made by others but first reported by Ray or Dillenius, are mainly grasses, sedges and rushes, but include also the delicate little wall bedstraw, found by William Sherard 'at Hackney, on a wall' in 1690 (Figure 16). It was not seen wild again in London until refound by Brian Wurzell in Markfield Recreation Ground, South Tottenham in 1985, where it still survives. Once known as *Gallium anglicum* it is now regarded as a subspecies of *G. parisiense*.

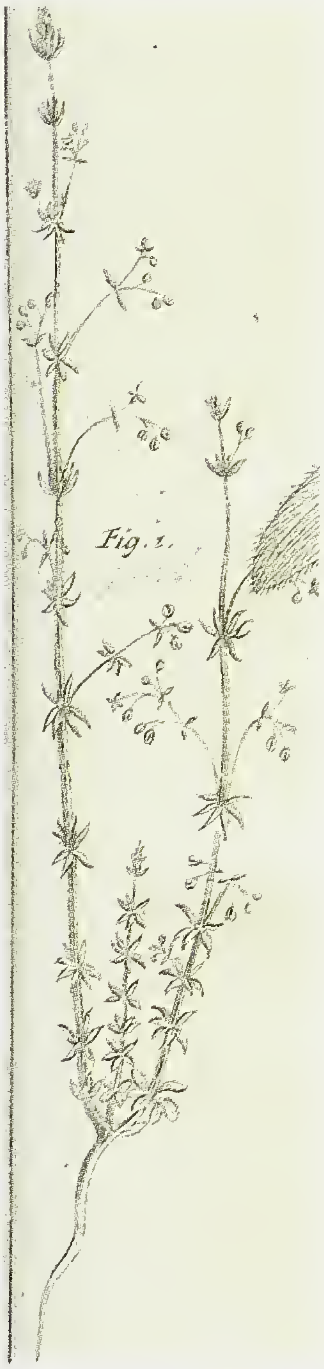


FIGURE 16. Wall bedstraw *Galium parisiense*, from the 1724 edition of Ray's *Synopsis*.

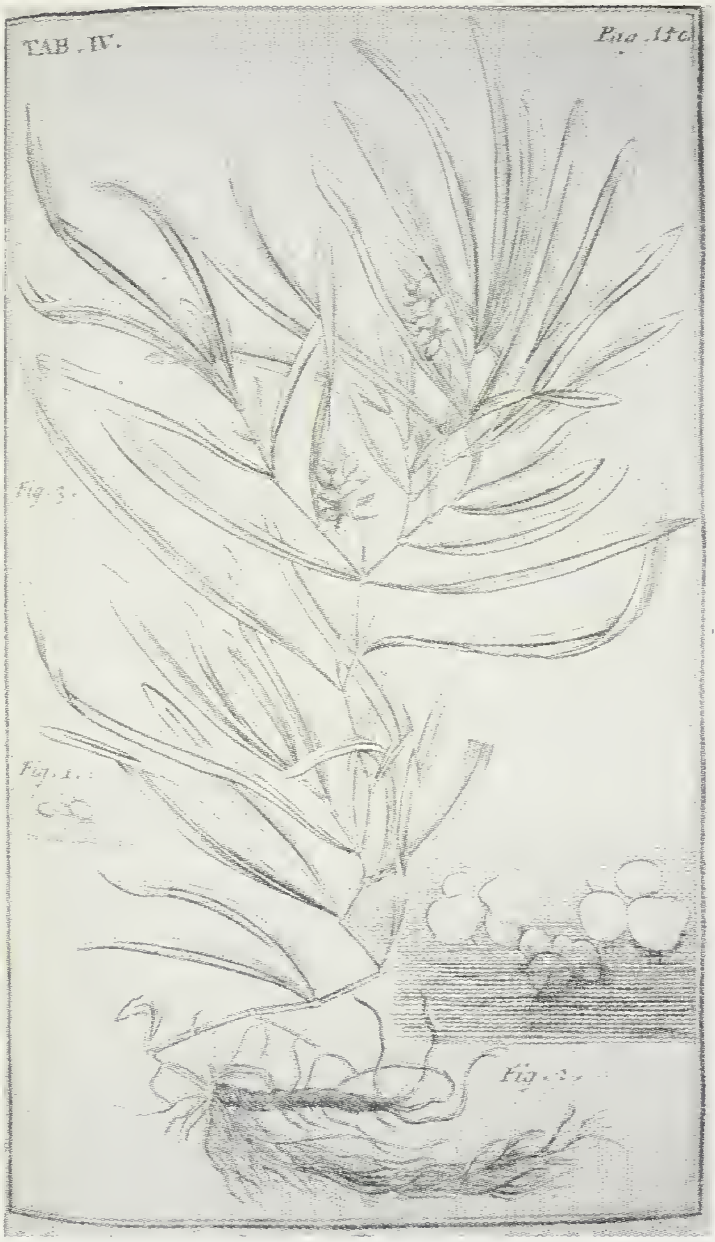

TAB. IV.
Fig. 3.
Fig. 1.
Fig. 2.

FIGURE 17. Blunt-leaved pondweed *Potamogeton obtusifolius*, from the 1724 edition of Ray's *Synopsis.*

Ray's correspondents included three younger botanists, the apothecaries James Petiver (*c.*1658–1718) and Samuel Doody (1656–1706) and the churchman Adam Buddle (*c.*1650–1715), the first and last of whom accumulated large herbaria. All were active in London. In 1695 Petiver saw *Carex leporina* oval sedge 'in a wood near the boarded river' (as the New River from Ware to Islington was called where it was carried in lead-lined channels over low ground, as over Hackney Brook near what is now Arsenal's Emirates Stadium) and the rare *Persicaria minor* small water-pepper on 'Ditch banks in the meadows [now Millbank] beyond Lord Peterborough's house at Westminster'. Buddle found *Potamogeton obtusifolius* blunt-leaved pondweed (Figure 17) in ditches near Deptford and Doody saw *Carex pilulifera* pill sedge on Hampstead Heath, to give just two examples of their first records.

Other notable records include *Fritillaria meleagris* snakeshead fritillary, found by a Mr Ashby at Ruislip about 1697; *Leucojum aestivum* summer snowflake that William Curtis saw on both sides of the Thames around the Isle of Dogs before 1788, and that John Stuart Mill refound on Plumstead Marsh on 16 May 1858, 'in such profusion as all the botanists in England would scarcely exhaust it' (Mill 1858); the extremely rare *Cyperus fuscus* brown galingale, found about 1820 by a Mr Haworth in a marshy meadow 'scarcely half a mile from Little Chelsea'; and *Fallopia dumetorum* copse bindweed found 'Sept. 20, 1834, in a wood at Wimbledon, by Mr J. A. Hankey'. The most recent discovery was of Britain's smallest flowering plant, *Wolffia arrhiza* rootless duckweed, discovered by Henry Trimen in a pond on Shortwood Common in 1866, but sadly no longer there.

The Appendix lists 185 first records of vascular plants (and one of a stonewort, *Chara hispida*) from the London Area. Earlier ones may yet lurk in herbaria and the older literature.

* * *

What sort of plants grew in the London of four centuries ago? Except for the low hills where the Romans built Londinium, the land beside the Thames was marshy. Aquatic plants and those of wetlands together amount to sixty-nine (thirty-seven per cent) of the first records. The city itself was surrounded by fields and pastures for the cattle, sheep and pigs that provided London with milk and meat; plants of these grasslands total thirty-nine (twenty-one per cent). There were few arable fields but much horticulture and these cultivated grounds supported another twenty-five (fourteen per cent). Woodland was managed as pasture and, particularly, as a source of fuel; demand rapidly outpaced supply and London's woods were much smaller in extent in Elizabeth's time than commonly supposed, contributing only twenty-three (twelve per cent) of the discoveries. Heaths and acid grassland accounted for thirteen records (seven per cent) while rough wastes and walls each contributed eight (five per cent) to the total. In comparison with the current national distribution of plants amongst these broad habitats, those of wetlands and cultivated ground were over-represented in London, the respective proportions being twenty-nine per cent and nine per cent across Britain as a whole, while those of broadleaved woods and, to a small extent, heaths were under-represented (sixteen and nine per cent). These differences are understandable in light of what we know of late mediaeval London and its surroundings.

More than one quarter of the plants first recorded in London can still be found almost everywhere in our district, that is in more than ninety per cent of its thirty-two hectads, while forty (twenty-two per cent) are restricted to fewer than ten per cent of the hectads. Of these forty, thirty-two occur nowhere, or in only one site, and are for all practical purposes extinct in London. The main reason is habitat loss. Drainage of bogs, fens and ponds, and the enclosure and development of heaths has resulted in plants of these habitats surviving only in the outermost fringes of our district. Arable weeds have suffered from modern agricultural practices. By contrast, hardly any plants of walls or waste ground have been lost while woodland plants have actually become more abundant as grazing has ceased and trees have replaced grassland in parks and commons.

* * *

The city itself, then as now, was well-treed. But one tree not present was, of course, the London plane, the plant that now dominates central London both in visual impact and biomass — it is 'aboute London, plentuously' and deserves some attention.

In 1548 Turner wrote: 'I never saw any plaine tree in Englande saving once in Northumberlande besyde Morpeth, and an other at Barnwel Abbey besyde Cambryge'. This was *Platanus orientalis* Oriental plane, native to south-east Europe and Asia. According to Richard Fitter (1945: 86) this was introduced to England in 1562, but Turner's records are earlier than that. It was known to Gerard, whose servant William Marshall brought fruit back from Lepanto. They were desirable trees, listed in John Tradescant's garden catalogue of 1634.

The origins of the London plane are obscure. It is either *P.* × *hybrida*, the hybrid between the Oriental and American plane, the latter brought to Europe sometime around 1650 (Fitter says 1636), or a variety of Oriental plane, examples of which in southern Europe look indistinguishable from our own. It arose before 1700 either in France or Italy, or (some claim) in Oxford Botanic Garden. The Great Plane at Magdalen College, with a girth of twenty-eight feet, has a plaque: 'This tree planted in 1801 is a scion of the hybrid plane first raised in the Botanic Garden in 1666.'

But is it a hybrid? Two of our Society's most respected recorders (and presidents) thought not. Ted Lousley (1976) wrote 'The evidence for a hybrid origin is not convincing' and Rodney Burton (1983: 75) added 'I . . . see little justification for supposing it to be a hybrid'. There are some well-documented self-sown trees beside the Thames on the Surrey bank, and Kent (1975: 301) commented on the freedom with which it regenerates in central London (though with nothing like the vigour of, say, sycamore). But outside London it is rarely fertile: in Hertfordshire, 'one solitary tree and a sapling' (James 2009); in Berkshire, 'seldom regenerating from seed' (Crawley 2005); in Oxfordshire, 'not recorded self-sown' (Killick et al. 1998). Given the huge quantity of seed produced, this suggests a genetic problem with fertility, consistent with but not proving a hybrid origin. The last word has to be with Stace (2010: 122): 'Of uncertain horticultural origin.'

Planes are very long-lived. Trees in Berkeley Square date from 1789 (some in Lincoln's Inn Fields may be older), those in some of the Bloomsbury squares from 1800–1820. Their natural lifespan is indeterminate; according to Paul Akers, Westminster Council's arboriculturist, 'Not one London plane has died of old age' (*Time Out*, October 2007). A pollarded Oriental plane in Crete is said to be over 1,000 years old (Grove and Rackham 2001).

The main threats are disease and predation. Since the 1970s, the fungus *Apiognomonia errabunda* = *Gnomonia platani*, plane anthracnose has infested all trees in London, leading to early leaf drop and thin crowns. Some anthracnose resistance has developed but there is a new threat, the leaf miner moth *Phyllonirycter platani*. This was first found in London in 1989 (like the tree, its origin is obscure) and has spread to parts of southern England. The combined effect of anthracnose disease and leaf-mining moths is potentially worrying.

Turner and his successors lived in a city floristically richer than we can easily imagine. We have lost much of that native richness but the example of the London plane, just one among the new arrivals in the last few centuries, ensures that London remains a wonderful place to study nature.

Acknowledgements

The list of London's first records could not have been compiled without innumerable visits to herbaria, particularly those at the Natural History Museum (**BM**) and Oxford University's Department of Plant Science (**OXF**); I am most grateful to Mark Spencer and Serena Marner, respectively, for their help in tracing specimens. Particular thanks are due to David Pearman, who has shared with me the results of his research on first records of plants throughout Britain, and thus enabled me to avoid many errors; those that remain are mine alone.

References

BABINGTON, C.C. 1836. *Trans. Linn. Soc. Lond.* **XVII**: 460.
BABINGTON, C.C. 1843. *English Botany: Supplement*. Vol. **iii**. London.
BLACKSTONE, J. 1737. *Fasciculus plantarum circa Harefield sponte nascentium*. London.
BURTON, R. M. 1983. *Flora of the London Area*. London Natural History Society.
CRAWLEY, M. J. 2005. *The flora of Berkshire*. Brambleby Books, Harpenden.
CURTIS, W. 1775–1798. *Flora Londinensis*: Vols **i-vi**. London.
DOODY, S. *c*.1695–1705. Notes written in a copy of Ray's *Synopsis* (1696), in NHM.
EDGINGTON, J.A. 2010. The first British record of *Nardus stricta* L. (Poaceae). *Watsonia* **28**: 123–127.
FITTER, R.S.R. 1945. *London's natural history*. Collins, London.
GERARD, J. 1597. *The herball or generall historie of plantes*. J. Norton, London.
GERARD, J. 1633. *The herball or generall historie of plantes . . . very much enlarged and amended by Thomas Johnson, citizen and apothecarye of London*. A. Islip, J. Norton and R. Whitakers, London.
GILMOUR, J.S.L. (ed.) 1972. *Thomas Johnson: botanical journeys in Kent and Hampstead*. Hunt Botanical Library, Pittsburgh.
GROVE, A.T. and RACKHAM, O. 2001. *The nature of Mediterranean Europe*. Yale University Press.
GUNTHER, R.T. 1922. *Early British botanists and their gardens*. Oxford.
HANBURY, F.J. and MARSHALL, E.S. 1899. *Flora of Kent*. London.
HILL, M.O., PRESTON, C.D. and ROY, D.B. 2004. *PLANTATT*. Centre for Ecology and Hydrology, Huntingdon.
HOOKER, W.J. 1816–1828. *Flora Londinensis* (continuation of Curtis's series). London.
[HOW, W.] 1650. *Phytologia Britannica*. R. Cotes, London.
JAMES, T. J. 2009. *Flora of Hertfordshire*. Hertfordshire Natural History Society.
JOHNSON, T. 1629. *Iter plantarum investigationis ergo susceptum*. London.
JOHNSON, T. 1632. *Descriptio itineris plantarum investigationis ergo suscepti*. R. Cotes, London.
JOHNSON, T. 1638. *Catalogus plantarum juxta Tottenham lectarum anno dom. 1638*. Copy of an original MS. Library, Royal Botanic Gardens, Kew.

JOHNSON, T. 1641. *Mercurius botanicus.* Part 2. London.
KENT, D.H. 1975. *The historical flora of Middlesex.* Ray Society, London.
KILLICK, J., PERRY, R. and WOODELL, S. 1998. *The flora of Oxfordshire.* Pisces Publications, Newbury.
LANKESTER, E. 1848. *Correspondence of John Ray.* Ray Society, London.
l'ECLUSE, C. de. 1601. *Rariorum plantarum historia.* Plantin, Antwerp.
l'OBEL, M. de and PENA, P. 1570. *Stirpium adversaria nova.* T. Purfoot, London.
l'OBEL, M. de 1576. *Plantarum seu stirpium historia.* Antwerp.
l'OBEL, M. de 1605. *Stirpium adversaria nova: Appendix.* London.
l'OBEL, M. de 1655. *Stirpium illustrationes* .... A selection of l'Obel's ms. records, some previously published by Parkinson (1640) without attribution, edited by William How. J. Kirton, London.
LOUSLEY, J.E. 1976. *Flora of Surrey.* David and Charles, Newton Abbot.
LUXFORD, G. 1837. *Trans. Linn. Soc. Lond.* **XVIII**: 687.
MERRETT, C. 1666. *Pinax rerum naturalium Britannicarum.* C. Pulleyn, London.
MILL, J. S. 1858. *Leucojum aestivum. Phytologist* N.S. **IIB**: 510.
MORISON, R. 1672. *Plantarum umbelliferarum distributio nova.* Oxford.
OSWALD, P. 2000. Historical records of *Lactuca serriola* L. and *L. virosa* L. in Britain, with special reference to Cambridgeshire (v.c. 29). *Watsonia* **23**: 149–159.
OSWALD, P.H. and PRESTON, C.D. 1998. A mare's-nest of horsetails: John Ray's treatment of 'Equisetum' in his *Cambridge Catalogue* (1660). *Nature in Cambridgeshire* **40**: 2–18.
PARKINSON, J. 1629. *Paradisi in sole: paradisus terrestris.* H. Lownes and R. Young, London.
PARKINSON, J. 1640. *Theatrum botanicum.* T. Cotes, London.
PETIVER, J. 1695*a*. More rare plants growing wild in Middlesex. *In* Gibson's translation of Camden's *Britannia.*
PETIVER, J. 1695*b*. *Museum Petiverianum: centuria prima.* London.
PETIVER, J. 1713. *Herbarii Britannici clariss. D. Raii catalogus cum iconibus ad vivum delineatis.* Tab. 1–50. London.
PETIVER, J. 1716. *Graminum, muscorum, fungorum, submarinorum, etc. Britannicorum concordia.* London.
PLUKENET, L. 1705. *Amaltheum botanicum* .... London.
PRESTON, C.D., PEARMAN, D.A. and DINES, T.D. 2002. *New atlas of the British and Irish flora.* Oxford University Press.
RAY, J. 1688. *Historia plantarum.* **2**. London.
RAY, J. 1690. *Synopsis methodica stirpium Britannicarum.* S. Smith, London.
RAY, J. 1696. *Synopsis methodica stirpium Britannicarum.* Ed. 2. S. Smith and B. Walford, London.
RAY, J. 1724. *Synopsis methodica stirpium Britannicarum*: Ed. 3. Edited by J. J. Dillenius. W. and J. Innys, London.
SMITH, J.E. 1804. *Flora Britannica* **3**. London.
STACE, C. 2010. *New flora of the British Isles.* Ed. 3. Cambridge University Press.
SYME, J. T. BOSWELL. 1865. *English Botany,* Ed. 3. **2**. Hardwicke, London.
SYMONS, J. 1798. *Synopsis plantarum insulis Britannicis indigenarum.* London.
TRIMEN, H. 1866. *J. Bot. Lond.* **4**: 219.
TRIMEN, H. 1870. *J. Bot. Lond.* **8**: 191 and 376–379.
TURNER, W. 1548. *The names of herbes in Greke, Latin, Englishe, Duche & Frenche wyth the commune names that Herbaries and Apotecaries use.* John Day and Wyllyam Setes, London.
TURNER, W. 1551. *A new herball.* Stephen Myerdman, London.
TURNER, W. 1562. *The seconde parte of Vuilliam Turners herball.* Arnold Birckman, Cologne.
TURNER, W. 1568. *The first and seconde partes of the herbal of William Turner, lately oversene corrected and enlarged with the thirde parte lately gathered* .... Arnold Birckman, Cologne.
WITHERING, W. 1787. *A botanical arrangement of all the vegetables naturally growing in Great Britain.* Ed. 2. Birmingham.

APPENDIX

A list of plants first recorded in the London Area, a twenty-mile circle about St Paul's Cathedral. Species names follow Stace (2010) and are followed by the number of ten-kilometre squares in this region, out of a maximum of thirty-two, in which the plant occurred between 1987 and 1999 (Preston et al. 2002). The first known record is cited. In most cases the locality is that given by the original observer, quotation marks '. . .' indicating a direct quote from English, asterisks *. . .* indicating a passage translated from the original Latin. Preferential habitats are derived from Hill et al. (2004).

Species	Authority	Locality	Habitat
Achillea ptarmica(20)	Gerard 1597: 484	"a village near London called Kentish Town"	Marshy ground
Aegopodium podagraria (32)	Merrett 1666: 61	"in Moorfields"	Wastes
Aira caryophyllea(17)	l'Obel 1605: 465	*On a dry hillside near Greenwich Palace*, probably *c.*1567 on l'Obel's arrival in England from Flanders	Heaths
Allium vineale(30)	Gerard 1597: 142	"the Mantels, on the backside of Islington"	Neutral grassland
Alopecurus myosuroides (27)	Ray 1724: 397	*Found by Buddle not far from Paddington* according to Doody; before 1706	Cultivated ground
Anchusa arvensis (19)	Johnson 1629: B2r; Gerard 1633: 799	Near Dartford (1629); "drie ditch bankes about Piccadilla" (1633)	Cultivated ground
Anthemis arvensis (3)	l'Ecluse 1601: 337	*I saw this plant [Parthenium pleno flore] for the first time in London, in 1579*. Petiver (1713: xix, 8) gathered it in "Peckham Fields"; and see Dillenius in Ray (1724: 185) for J. Sherard's record "betwixt Eltham and Shootershill".	Cultivated ground
Anthriscus caucalis(10)	Johnson 1632: 32	On or near Hampstead Heath	Acid grassland
Anthyllis vulneraria (10)	Gerard 1597: 1061	"upon Hampstead Heath neere London . . . also upon blacke Heath"	Basic grassland
Arabidopsis thaliana (32)	Merrett 1666: 93	"ditch sides in the way to Marybone and . . . the lane from Islington to Kingsland"	Wastes
Arrhenatherum elatius (32)	Gerard 1597: 22	"in the fields next to St James wall as ye go to Chelsey, and from Tower-hill to Radcliffe"	Neutral grassland
Asplenium ruta-muraria(24)	Gerard 1597: 983	"upon the wall of the churchyard of Dartford . . . also upon the walls of the Churchyard of Sittingburne"	Walls
Atriplex patula (31)	Johnson 1629: B3r	Between Hampstead and Kentish Town. Johnson's record of *Atriplex* from Kent in the same year is not securely identifiable.	Cultivated ground
Atriplex prostrata (31)	Johnson 1629: B3r	Between Hampstead and Kentish Town; and see above	Cultivated ground
Bidens cernua (22)	l'Obel & Pena 1570: 227	*damp ground everywhere in England, especially London*	Marshy ground
Botrychium lunaria(0)	l'Obel & Pena 1570: 360	Near *the King's House at Greenwich*, probably *c.*1567 on l'Obel's arrival in England from Flanders	Basic grassland
Brachypodium sylvaticum(30)	Johnson 1629: B3r	Ken Wood, between Highgate and Hampstead Heath. Probably not *B. pinnatum* to which Johnson's name refers.	Broadleaved woods

Brassica rapa (20)	Parkinson 1640: 864	"going from Shoreditch by Bednal Green to Hackney"	Cultivated ground
Bromopsis benekenii (2)	Trimen 1870: 191	"Trimen described a specimen in Sowerby's herbarium labelled "near the 'Plough', Camberwell"	Broadleaved woods
Bromus secalinus (5)	Merrett 1666: 49	"Plentiful in the Woods below Hampsted". Doubtful; possibly *Bromopsis ramosa* was intended.	Cultivated ground
Calamagrostis epigejos (20)	l'Obel 1655: 42	Recorded (as Calamagrostis silvae D. Johannis) *beyond Highgate* by l'Obel, before 1615. See Parkinson (1640: 1180)	Marshy ground
Callitriche platycarpa (12)	Hb. Sloane (BM)	"observed [by Sloane] in a Bog on Putney Heath, June 4 1691" according to Petiver's label at Vol. 151: 36	Water
Cardamine amara (10)	Merrett 1666: 20	"in a bog betwixt the Duke of Norfolks garden and Lambeth Church"	Marshy ground
Carex acuta (13)	Blackstone 1737: 35	Harefield, Middlesex	Marshy ground
Carex acutiformis (26)	Petiver 1716: 159	"Mr Ja. Sherard first observed this in a pond near Eltham about the end of May; and Mr Rand, in the ditches at the King's Arms against Whitehall"	Marshy ground
Carex caryophyllea (7)	Johnson 1632: 33	On or near Hampstead Heath	Basic grassland
Carex demissa (12)	Gerard 1597: 16	"Saint Georges fields [Southwark] and suchlike places"	Marshy ground
Carex depauperata (0)	Withering 1787: 1049	Found by Dr Goodenough "in a small wood at the back of Charlton Church"	Broadleaved woods
Carex flacca (25)	Hb. du Bois (OXF)	The label reads "Found by the Banks of the New River by Mr Miller [Phillip Miller, 1691–1771]" and refers to Ray (1696), thus antedating Ray (1724); probably, like most of du Bois' specimens, collected before 1716	Marshy ground
Carex hirta (32)	l'Obel 1655: 51	*Collected by [the Dutch plant collector] Wilhelm Boel from marshy fields near Highgate*, before 1615. See Parkinson (1640: 1172)	Marshy ground
Carex leporina (26)	Petiver 1695*a*: 338	"In a wood near the boarded river [the New River, culverted in north London]"	Neutral grassland
Carex panicea (15)	Petiver 1716: 6	"On Chiselhurst and other bogs"	Marshy ground
Carex pilulifera (20)	Ray 1688: 1910	*Found on Hampstead Heath near London by Dr Samuel Doody*	Acid grassland
Catabrosa aquatica (6)	l'Obel 1655: 10	*. . . in wet London fields near the Thames, a most delightful stream*, probably seen by l'Obel about 1600. See Parkinson (1640: 1174)	Marshy ground
Cephalanthera damasonium (8)	Lankester 1848: 4	Found about 1661 at Rough-hill [Rowhill], near Dartford, by Thomas Willisell who marked the spot with a stake. Ray searched unsuccessfully for it. Ten years later (Lankester 1848: 85) Willisell found it again, near Greenhithe	Broadleaved woods

Cerastium glomeratum (30)	Merrett 1666: 6	"neer Hamsteed Church, and in Hide Park"	Cultivated ground
Cerastium pumilum (1)	Curtis 1775–98: vi. 30	Found, new to science, by James Dickson "on dry banks near Croydon", *c.*1795	Basic grassland
Cerastium semidecandrum(10)	Ray 1724: 348	*here and there about London*, with an illustration	Acid grassland
Ceratocapnos claviculata (10)	Gerard 1597: 929	"in a corne field betweene a small village called Charleton and Greenwich"	Broadleaved woods
Ceratophyllum demersum (29)	Merrett 1666: 36	"In the ditches beyond Southwark and betwixt Limehouse end and Blackwall"	Water
Chamaemelum nobile (6)	Turner 1548: B i	"groweth on Rychmund grêne and in Hundsley [Hounslow] heth in great plentie"	Acid grassland
Chenopodium ficifolium (28)	Petiver 1713: viii, 4	"Buddle's Fig Blite. Lond." A specimen in Hb. Buddle (117: 38) about 1710 is the first as a British plant.	Cultivated ground
Chenopodium glaucum (3)	Petiver 1713: viii, 1	"Rand's Oak Blite. London". Tothill Fields, Westminster; shown to Buddle by James Rand, *c.*1705.	Cultivated ground
Chenopodium rubrum (26)	Johnson 1629: B3v	Between Hampstead and Kentish Town	Cultivated ground
Chenopodium urbicum (0)	Petiver 1713: viii, 8	"Broad pointed Blite. Lond."	Cultivated ground
Chenopodium vulvaria(1)	Johnson 1632: 32	On or near Hampstead Heath	Cultivated ground
Cicuta virosa (0)	Gerard 1633: 256	"found by Mr Goodyer in the ponds about Moore Parke [near Rickmansworth]". Goodyer recorded it here on 16 September 1625 (Gunther 1922: 54)	Marshy ground
Clinopodium vulgare(20)	Turner 1548: B vii	"it groweth muche about Syon". Probably this species, not *Clinopodium ascendens*	Basic grassland
Convallaria majalis (8)	Gerard 1597: 332	"on Hampsted heath, foure miles from London, in great abundance"	Basic grassland
Cruciata laevipes (14)	Gerard 1597: 965	"in the Churchyard of Hampstead . . . and in the highway beyond Charlton"	Neutral grassland
Cymbalaria muralis (31)	Parkinson 1640: 681	"About Hatfield in Hartfordshire". First British record of this now-ubiquitous alien	Walls
Cynosurus cristatus (32)	l'Obel 1605: 467	*frequent in several grassy London fields near Hackney*	Neutral grassland
Cyperus fuscus(1)	Hooker 1821: fig. 85	"A.H. Haworth Esq. found it [in 1819] in a low marshy meadow [Eel Brook Common] scarcely half a mile from Little Chelsea". J.E. Gray's statement (*J. Bot.* 9: 148 (1871)) that the plant had been deliberately sown was strongly repudiated by H. Trimen (*loc. cit.*) and is discussed by Kent (*Lond. Nat.* 37: 180 (1958)).	Marshy ground
Dactylorhiza fuchsii (30)	Gerard 1597: 170	"in Swainescombe wood neere to Gravesend . . . and in Hampsted wood foure miles from London". Perhaps this species	Marshy ground

Dactylorhiza praetermissa (23)	Gerard 1597: 170	Recorded from the same stations as *D. fuchsii* above, and possibly this species	Marshy ground
Damasonium alisma (0)	Gerard 1633: 418	"Mr Goodyer found it . . . upon Hounslow Heath". The date was 30 July 1618 (Gunther 1922: 110)	Marshy ground
Dianthus deltoides (1)	Gerard 1597: 476	"neere about London . . . especially in the great field next to Detford"	Neutral grassland
Diplotaxis tenuifolia (30)	Gerard 1597: 192	"most bricke and stone wals about London . . . covered with it"	Walls
Dryopteris affinis agg. (25)	Ray 1724: 120	Found before 1705 by Doody in Chelsea Physic Garden and Kenwood. Plukenet (1705: 91) wrote *this male fern with narrow, untoothed pinnules, having dark spots set, roughly pairwise, next to the rachis, cannot really be considered a distinct species*, but it is a good, and the earliest, description of *D. affinis*. (Newman's *Dryopteris filix-mas* var. *affinis*, applied by Druce to specimens in **OXF** found by Buddle at Charlton before 1715, is an extreme form of *D. filix-mas*)	Broadleaved woods
Dryopteris carthusiana (18)	Hb. Dillenius (**OXF**)	The first certain records are specimens from Kenwood, Shooters Hill and Woolwich Common, possibly gathered by Doody before 1705	Broadleaved woods
Epilobium obscurum (20)	Hb. Dillenius (**OXF**)	Specimens labelled by Dillenius "Hampstead bog"; probably before 1734 (label possibly transposed with specimens of *E. palustre* from Anglesey)	Marshy ground
Epilobium roseum (18)	Symons 1798: 199	Found by William Curtis on Lambeth Marsh	Marshy ground
Epipactis palustris (1)	l'Obel 1655: 94	*I gathered this from flooded meadows at Mary Cray, seven miles from London, in the late summer of 1601*	Marshy ground
Equisetum fluviatile (17)	Johnson 1638	In the neighbourhood of Tottenham, according to Kent (1975)	Water
Equisetum palustre (20)	Ray 1724: 131	"Found by the Rev. Mr Buddle on a new dug bog on Hounslow Heath" before 1715. Possibly this was actually the next species	Marshy ground
Equisetum ramosissimum (0)	Hb. Buddle (BM)	Hounslow Heath. Based on a specimen collected by Buddle before 1715 and recently identified as this.	Marshy ground
Equisetum sylvaticum (5)	l'Obel 1655: 149	*scattered in woods on Highgate Hill*, before 1615. See Parkinson (1640: 1201)	Broadleaved woods
Erica cinerea (13)	Gerard 1597: 1199	"Hampsteed Heath neere London"	Heaths
Eriophorum angustifolium (5)	Gerard 1597: 27	"a bog at the further end of Hampstead"	Bogs
Erophila verna agg. (26)	Gerard 1597: 500	"upon the bricke wall in Chancerie Lane belonging to the Earle of Southampton"	Walls

Fallopia dumetorum (2)	Babington 1836: 460	"Found Sept. 20, 1834, in a wood at Wimbledon, by Mr J. A. Hankey". An apparently earlier record by George Luxford near Reigate in 1826 is based on a note on the original drawing (at BM) for Sowerby's *Eng. Bot. Supp.* 2811 (1837)	Broadleaved woods
Frangula alnus (14)	Gerard 1597: 1286	"in a wood a mile from Islington . . . toward Harnsey . . . and at Hampsted"	Broadleaved woods
Fritillaria meleagris (1)	Blackstone 1737: 29	"In Maud-fields near Ruislip Common, observed above 40 years ago by Mr Ashby"	Marshy ground
Fumaria parviflora (0)	Gerard 1597: 929	"in a corne field between . . . Charleton and Greenwich"	Cultivated ground
Galium parisiense (2)	Ray 1690: 237	"Found at Hackney on a wall" by William Sherard (1659–1728)	Walls
Galium uliginosum (4)	Hb. Buddle (BM)	Specimens from"ditches near Hampstead", before 1715	Marshy ground
Geranium robertianum (32)	Johnson 1629: B3v	Between Hampstead and Kentish Town	Broadleaved woods
Gnaphalium sylvaticum (1)	l'Obel & Pena 1570: 202	*on this side [north] of the Thames in a dense wood three miles from London*	Heaths
Helminthotheca echioides (32)	Turner 1551 (p. 144 in 1568 edn.)	"In great plentye betwene Sion and Branfurd [Brentford]"	Cultivated ground
Himantoglossum hircinum (1)	Johnson 1641: 27	"Nigh the highway between Crayford and Dartford"	Basic grassland
Hottonia palustris (10)	Gerard 1597: 679	"the water ditches adjoyning to Saint George his field [Southwark]"	Water
Hyacinthoides non-scripta (30)	Turner 1548: D vi	"about Syon and Shene"	Broadleaved woods
Hydrocharis morsus-ranae (6)	l'Obel & Pena 1570: 258	*by the Tower of London*	Water
Hypericum tetrapterum (26)	Turner 1548: B iii	"in Syon parck"	Marshy ground
Juncus acutiflorus (25)	Johnson 1632: 34	On or near Hampstead Heath	Marshy ground
Juncus bufonius (32)	Gerard 1633: 4	Johnson found it "in the lane going by Totenham Court towards Hampstead"	Marshy ground
Juncus bulbosus (17)	Gerard 1633: 4	Found by Johnson growing "on the bogges upon Hampstead heath"	Marshy ground
Juncus subnodulosus (3)	Ray 1724: 433	*found in Peckham-field* by Doody, before 1706	Marshy ground
Lactuca serriola (31)	Johnson 1632: 32	"between London and Pancridge [St Pancras Old] Church" (see Oswald 2000)	Wastes
Lamiastrum galeobdolon (22)	Gerard 1597: 568	"under the hedge as you go from the village of Hampstead to the Church"	Broadleaved woods
Lamium hybridum (16)	Merrett 1666: 69	"In the Kings new Garden near Goring-house [Buckingham Palace]"	Cultivated ground

Lathyrus nissolia (32)	Johnson 1632: 36	"pasture and meadow grounds about Pancridge [St Pancras Old] Church". See Gerard (1633: 1250)	Neutral grassland
Lathyrus palustris (0)	Merrett 1666: 70	Found by Thomas Willisell "In a wet marsh ground on . . . Peckham Field"	Marshy ground
Lathyrus sylvestris (6)	Gerard 1597: 1053	"in Swanescombe wood a mile and a halfe from Greene-hithe in Kent as you go to a village thereby called Betsome [Betsham]"	Broadleaved woods
Leersia oryzoides (1)	Hb. Goodenough (K)	Specimen labelled "Kew, September", probably before 1805, the latest date in Goodenough's herbarium; *teste* T. Cope (information from D. Pearman)	Marshy ground
Legousia hybrida (5)	Gerard 1597: 356	"among the corne by Greenhithe"	Cultivated ground
Lemna trisulca (30)	Gerard 1597: 681	"in a ditch by Bermondsey house [a mansion on the site of Bermondsey Priory]"	Water
Leucojum aestivum (0)	Curtis 1775–98: v. 23	"betwixt Greenwich and Woolwich . . . also . . . in the Isle of Dogs", *c.*1788	Marshy ground
Lotus tenuis (8)	Doody *c.*1695–1705	"Found 1696 about Greenwich and Greenhithe". See Hanbury & Marshall (1899: 97)	Neutral grassland
Luzula campestris (32)	Gerard 1597: 16	"In watery ditches from Paris garden bridge to Saint Georges fields [Southwark]"	Neutral grassland
Luzula forsteri (14)	Smith 1804: 1395	"Mr Edward Forster first observed this in 1795 . . . between Hog Hill and Collier Row in Hainhault Forest"	Broadleaved woods
Luzula sylvatica (16)	l'Obel 1655: 39	"in woods . . . about Highgate", before 1615. See Parkinson (1640: 1184)	Broadleaved woods
Lysimachia vulgaris (16)	Turner 1548: E ii	"by the Temes syde beside Shene"	Marshy ground
Lythrum salicaria (32)	Gerard 1597: 388	"under the Bishops house wall at Lambeth, neere the water of Thames"	Marshy ground
Matricaria chamomilla (32)	Johnson 1632: 36	On or near Hampstead Heath	Cultivated ground
Medicago arabica (30)	Johnson 1632: 33	On or near Hampstead Heath	Wastes
Melampyrum pratense (16)	Gerard 1597: 84	"Hampsted heath . . . . among the Juniper bushes and bilberry bushes"	Broadleaved woods
Mentha pulegium (0)	Turner 1562: 107	"besyde hundsley [Hounslow] upon the heth"	Marshy ground
Mespilus germanica (1)	Merrett 1666: 77	"In the Hedges betwixt Hampsted-heath and Highgate". Apparently the first record in the wild.	Broadleaved woods
Myosotis laxa (17)	Hb. Dillenius (OXF)	Specimen labelled by Dillenius *on Hounslow Heath in a bog that regularly dries out*, probably before 1734	Marshy ground

Myosotis sylvatica (29)	Merrett 1666: 82	"In Charlton and many other woods in Kent"	Broadleaved woods
Myosurus minimus (0)	Gerard 1597: 345	"Upon a barren ditch banke . . . as ye go from London to . . . Hampstead; in a field as you goe from Edmonton . . . unto a house thereby called Pims"	Cultivated ground
Nardus stricta (15)	Gerard 1633: 1630	Found in August 1633 by Johnson "at Chissel-hurst . . . going over the heath there". Plants found by Johnson on Hampstead Heath in 1629 and 1632 are probably not this species (Edgington 2010)	Acid grassland
Oenanthe aquatica (7)	Gerard 1597: 905	"ditches by a causey [causeway] as you go from Redreffe [Rotherhithe] to Detford"	Water
Oenanthe crocata (26)	Turner 1548: H iiii	"by the Temmes syde about Shene"	Marshy ground
Oenanthe fistulosa (4)	Gerard 1597: 902	"in S. Georges fields, and about the Bishop of Londons house at Fulham"	Marshy ground
Ononis spinosa (7)	l'Obel & Pena 1570: 378	*in wet coastal meadows, especially near London*	Neutral grassland
Onopordum acanthium (19)	Turner 1562: 146	"besyde Sion in England"	Wastes
Ophioglossum vulgatum (23)	Gerard 1597: 327	"a Meadow neere the preaching Spittle [Spitalfields] ... the Mantels [Islington]"	Neutral grassland
Ornithogallum umbellatum (20)	Turner 1548: E vii	"I never sawe it in Englande, savyng onely besyde Shene herde by the Temmes syde"	Neutral grassland
Ornithopus perpusillus (22)	l'Obel & Pena 1570: 403	*arising in grassy verges at Royal Greenwich*, probably *c.*1567 on l'Obel's arrival in England from Flanders	Acid grassland
Osmunda regalis (4)	Gerard 1597: 969	"a bog at the further end of Hampsted heath . . . neere unto Bruntwood in Essex"	Marshy ground
Persicaria minor (4)	Petiver 1695*b*: 13	"Ditchbanks in the meadows beyond Lord Peterborough's house at Westminster". Petiver found the plant in autumn 1695; see Ray (1696: 324)	Marshy ground
Persicaria mitis (5)	Hb. Dillenius (**OXF**)	Three specimens marked "Insipida, Chelsey" in Dillenius's hand, and perhaps gathered by him *c.*1730, appear to be this species. They were collected a century earlier than the plant found in 1826 by Prof. La Gasca, of Madrid, "by the roadside at Chelsea" (Babington 1843: 2867)	Marshy ground
Petrorhagia cf. *nanteuilii* (0)	How 1650: 10	"In the grounds 'twixt Hampton Court and Tuddington". The plant may have been *Dianthus deltoides*	Neutral grassland
Phalaris arundinacea (31)	l'Obel 1655: 44	*growing by the banks of rivers and ditches, as on the road to Ratleam [Ratcliffe]*, *c.*1600. See Parkinson (1640: 1273)	Marshy ground
Phleum pratense (32)	Gerard 1633: 11	Recorded by Johnson from "Chelsey field, as one goeth from Saint James to little Chelsey [West Brompton]"	Neutral grassland

Plantago coronopus (25)	Turner 1548: C v	"groweth muche aboute Shene above London"	Neutral grassland
Polygonum arenastrum (28)	Hb. Dillenius (**OXF**)	Specimen labelled by Dillenius *in the Hackney direction*, probably before 1734	Cultivated ground
Polygonum rurivagum (2)	Ray 1724: 146	"About Camberwell, and amongst the Corn in Houndfield by Poundersend plentifully"	Cultivated ground
Polystichum setiferum (21)	Hb. Rand (**BM**)	Rand's specimen of *c.* 1730 from "the Holloway between Bromley and Chiselhurst" is this species. Earlier records do not distinguish it satisfactorily from *P. aculeatum*	Broadleaved woods
Populus alba (28)	Gerard 1597: 1302	"at the further end of a village called Black-wall, from London"	Cultivated ground
Potamogeton lucens (2)	Petiver 1695*a*: 337	"Many places in Thames between Fulham and Hampton Court"	Water
Potamogeton obtusifolius (8)	Ray 1724: 149	*ditches near Deptford*. Found by Buddle before 1715; his specimen in Hb. Buddle is illustrated by Dillenius	Water
Potamogeton perfoliatus (5)	Johnson 1638	In the neighbourhood of Tottenham	Water
Potamogeton pusillus (17)	How 1650: 97	"Between Carleton and Wulwich"	Water
Ranunculus aquatilis (15)	Hb. Dillenius (**OXF**)	Specimen labelled by Dillenius *in a bog at Hampstead*; probably before 1734	Water
Ranunculus circinatus (9)	Hb. Dillenius (**OXF**)	Specimen labelled by Dillenius "Isle of Dogs"; probably before 1734	Water
Ranunculus sardous (10)	Merrett 1666: 102	"Below Hampstead in the meadows betwixt the Town and Heath"	Marshy ground
Ranunculus sceleratus (32)	Johnson 1629: B3v	Hampstead Heath	Marshy ground
Rorippa amphibia (20)	Gerard 1597: 186	"in the chincks amongst the mortar of a stone wall that bordereth upon the Thames by the Savoy in London"	Marshy ground
Rumex palustris (15)	Johnson 1629: B2v	Erith (probably Crayford) marshes; not then distinguished from *R. maritimus*	Marshy ground
Rumex pulcher (13)	Merrett 1666: 69	"Common in St George's Fields, and other places about London"	Neutral grassland
Salix repens (7)	Gerard 1597: 1205	"a bog . . . at the further end of Hampsted heath"	Heaths
Salix viminalis (30)	Johnson 1632: 35	On or near Hampstead Heath; probably this species	Marshy ground
Salvia verbenaca (6)	l'Ecluse 1601: xxxi	*at Greenwich near the race-course of the Palace*, 1579. "In the fieldes of Holburne neere unto Graies Inne" (Gerard 1597: 628) is later	Neutral grassland
Sanguisorba officinalis (5)	Turner 1548: H i	"it groweth muche about Syon and Shene"	Neutral grassland

Saxifraga tridactylites (15)	Gerard 1597: 500	"Upon the bricke wall in Chauncerie Lane belonging to the Earl of Southampton"	Walls
Schedonorus arundinaceus (32)	Ray 1688: 1909	*seen by Dr Doody on the banks of the Thames between London and Chelsea*	Neutral grassland
Schedonorus giganteus (31)	Ray 1688: 1909	*seen at Fulham by Dr Doody between the landing-stage and the Bishop's palace*	Broadleaved woods
Schoenoplectus triqueter (0)	Merrett 1666: 67	"At the Horse-ferry at Westminster". Seen by How "by ye horsferry" about 1650, according to his ms. note in his copy of *Phytologia Britannica,* now at Magdalen College, Oxford.	Water
Schoenoplectus × *carinatus* (0)	Petiver 1716: 199	"This Mr Doody has observed about Limehouse; I have also found it in his company near the Thames on this side Batersey Meadows"; before 1706	Water
Scilla autumnalis (1)	Parkinson 1629: 132	"a high banke by the Thames side at the hither end of Chelsey"	Neutral grassland
Scrophularia nodosa (30)	Gerard 1597: 580	"in a wood as you go from London to Harnesey [Hornsey]"	Broadleaved woods
Scutellaria galericulata (26)	l'Obel 1576: 186	*along river banks and in field hollows around London*	Marshy ground
Scutellaria minor (8)	Gerard 1597: 466	"the bog . . . at the further end of Hampsteed heath"	Marshy ground
Serratula tinctoria (7)	Gerard 1597: 577	"In Hampsted wood; likewise . . . in the wood adjoining to Islington"	Basic grassland
Setaria viridis (12)	Merrett 1666: 56	"In a field betwixt Tuddington and Hampton Court"	Cultivated ground
Sherardia arvensis (28)	Turner 1548: A vii	"I coulde never see but once in Englande and that was a little from Syon"	Basic grassland
Silene baccifera (0)	Luxford 1837	Found in August 1837 on the Isle of Dogs "on the banks of a ditch on the left hand of the road from Blackwall to the Ferry-House"; specimens in LINN	Broadleaved woods
Silene italica (1)	Syme 1865: 65	"along the side of the road between Dartford and Darenth", *c.*1860. Older records from east Kent are probably *S. nutans*	Wastes
Sison amomum (29)	Turner 1548: G iii	"besyde Shene"	Wastes
Sisymbrium irio (15)	Merrett 1666: 66	*growing everywhere around London*. But seen by Goodyer, probably before 1642, "near White Chappel east from Aldgate" according to How's ms. note in his *Phytologia Britannica* at Magdalen College, Oxford	Walls
Sonchus palustris (1)	Merrett 1666: 115	Found by Thomas Willisell "In the meadows betwixt Woolwich and Greenwich"	Marshy ground
Spiranthes spiralis (8)	Turner 1548: F viii	"groweth besyde Syon"	Neutral grassland
Stachys palustris (28)	Gerard 1597: 852	"in moist meadows . . . neere to Gravesend . . . and by Lambeth neere London"	Marshy ground

Stellaria graminea (32)	Johnson 1629: B3v	Between Hampstead and Kentish Town	Neutral grassland
Thalictrum flavum (6)	Gerard 1597: 1067	"Ditch sides leading from Kentish street [Old Kent Road] unto Saint Thomas a-Waterings [a well near St George's, Southwark, dedicated to Thomas a-Becket] . . . also . . . from Blacke-wall to Woolwich"	Marshy ground
Tordylium maximum (0)	Morison 1672: 40	*here and there in ditch sides and field margins around London*	Neutral grassland
Tragopogon pratensis (32)	Turner 1548: B v	"groweth in the fieldes about London plentuously"	Neutral grassland
Trifolium micranthum (25)	Hb. Buddle (BM)	Specimens from Tothill Fields, Westminster, before 1715; see Kent, *Lond. Nat.* 29: 3 (1950)	Acid grassland
Tripleurospermum inodorum (31)	Morley MSS., 1677–79	Hampstead; cited by Kent (1975)	Cultivated ground
Turritis glabra (1)	Gerard 1597: 213	"at Pyms by a village called Edmonton neere London"	Neutral grassland
Typha angustifolia (21)	l'Ecluse 1601: ccxv	*abundant in a muddy ditch near Tyburn*, 1581	Water
Valerianella carinata (11)	Woods *Trans. Linn. Soc.* xvii, 1835: 433	"Gathered by Mr E. Forster [on walls at Marden Ash] at Ongar, Essex". The site is just within the LNHS area	Walls
Valerianella dentata (8)	Ray 1724: 201; and Hb. Dillenius (OXF)	"in the third or fourth field on the right hand of the Road going from London-Coney towards St Albans: Mr Dale." A specimen labelled with Ray's polynomial and "Dale sumpsit" [gathered by Dale] in Hb. Dillenius may be from this site	Cultivated ground
Verbascum lychnitis (7)	Gerard 1597: 629	"black Heath . . . about the Queens house at Eltham . . . about Highgate"	Acid grassland
Verbascum thapsus (31)	Gerard 1597: 630	"black Heath . . . about the Queens house at Eltham . . . about Highgate", as above	Wastes
Veronica chamaedrys (32)	Gerard 1597: 531	"in manie places about London in Medowes and fertil fields"	Neutral grassland
Veronica serpyllifolia (32)	Turner 1548: B v	"groweth in Englande in a parke besyde London" and later (1551) "in dyverse woddes not far from Syon"	Neutral grassland
Vicia hirsuta (30)	Johnson 1629: B3v	Between Hampstead and Kentish Town. "Johnson's *Vicia* spp. are difficult to interpret" (Gilmour, 1972). Here I follow Kent (1975)	Neutral grassland
Vicia lathyroides (1)	Ray 1724: 321	"Found by Mr J.Sherard and Mr Rand on the Chalky banks near Green-hithe"	Acid grassland
Vicia sativa (27)	Johnson 1629: B3v	Between Hampstead and Kentish Town. Comments as for *Vicia hirsuta*	Neutral grassland
Viola hirta (18)	Merrett 1666: 125	"In Charlton Wood and in the lane . . . to Sittingbourne and the way to Lewsham"	Basic grassland
Wolffia arriza (0)	Trimen 1866: 219	"pond near the railway bridge on Staines [Shortwood] Common, June 14, 1866"	Water
Chara hispida (NA)	Gerard 1633: 1115	"divers ditches, as in Saint Iames his Parke, in the ditches on the backe of Southwarke towards Saint Georges fields, &c." See Oswald and Preston (1998)	Water

Book review

Wild flowers. Sarah Raven, photography by Jonathan Buckley. Bloomsbury Publishing. 2011. 500 pp., colour illustrated. £50. ISBN 978 1 4088 1394 2.

This is not a small book, being slightly larger than A4, 5 cm thick and weighing about two and a half kilograms. Unfortunately the review copy was poorly bound — the cover was separating from the block of pages, crackled on opening, and pages 11–14 actually fell out, not being attached at all. Apart from that, it's printed on high-quality Gardapat Kiara paper and beautifully presented with a proper bluebell of the front cover and Sarah Raven in pensive mood in a bluebell wood on the back. On opening it you are presented with a magenta flyleaf, followed on successive pages by an unlabelled photo of small scabious, the title page printed over another bluebell wood, the dedication with yellow archangel and more bluebells, an unnamed umbellifer opposite the contents page then a full-page photo of Ms Raven on a granite headland. By the time you get here you suspect that the book is not just another identification guide and the introduction that follows confirms it, reinforced by the idiosyncratic order of the species. They are sorted into eight habitat types, e.g., wood; lane, wall and hedge; meadow, etc., and within these groups the plants are in alphabetical order of common name. Woods are dealt with first, so the first one you encounter is bird's-nest orchid, followed by bluebells then broad buckler fern, rather jarring for a serious botanist but that is not who this book is designed for. Plants that may be found in several habitat types are described in their preferred one then listed at the beginning of the others. Five hundred species are included and there are two accounts per page, each consisting of a photo of the plant, a rather folksy introduction to it that some may find a bit twee, a brief description, a few associated species and the plant's distribution in the British Isles. Some grasses and sedges are included but there are no rushes or horsetails. At the end are several pages of double-spread photographs, a series of thumbnails of each plant organized by flower colour then alphabetical indexes of common name, Latin name (most of them following the recent changes) and family name.

This book is a hymn to the world of plants and very personal, so much so that you sometimes feel you are intruding into Ms Raven's soul, and probably tells us as much about her as it does about plants. She clearly cares about both plant and animal wildlife and has put a lot of work into producing this monument to flowers and to the father with whom she botanized in her youth. The introduction to each species contains interesting information about the place of the plant in our language and culture and its interaction with other wildlife. The photographs, most of then taken by Jonathan Buckley, are superb and range from individual flowers to sweeping landscapes. At the end of each habitat section are two-page photographic spreads referencing the appropriate plant description, although the photos are not referenced from the descriptions themselves, perhaps because there are no page numbers on the photos. On a few of them, such as the aforementioned umbellifer and the lady orchid on page 450, there is no indication at all of which plant is illustrated but it does give the impression that one of the purposes of the book is to showcase Mr Buckley's photographs. The frequent photos of Sarah Raven with others of Jonathan Buckley a pony and a dog, just underline the personal nature of the book.

The question is: who is the book designed for? It's not a field guide and the species coverage and sequence are too limited and haphazard for serious identification at home. The recommended retail price of £50 might deter the casual bibliophile but you can get it more cheaply and it's an attractive book, evocatively illustrated. Those who know Sarah personally might find it irresistible but for the rest of us perhaps it's something you might put on the coffee table and browse to bring peace when the world is too much with you. In the words of Sarah Raven herself, '. . . this book might encourage you to look at wild flowers with fresh eyes', and anything that stimulates people, especially younger ones, to take an interest in the plants which are such an important part of the world in which we live can only be a force for the better.

George Hounsome

The Entomology collections at the Natural History Museum — from collection enhancement to public outreach*

ERICA McALISTER

Department of Entomology, Natural History Museum, London SW7 5BD

Abstract

The Entomology Department at the Natural History Museum, London has recently undergone a major physical as well as a cultural change. Both the collections and the staff employed there have been rehoused, and the new building enables higher standards of collections care, that also provide an increased understanding of the collections and the research undertaken on them to the general public.

Introduction

The Natural History Museum and its collections is no stranger to change during its illustrious history having moved sites several times as well as dividing and splitting along the way. Since the original concept brought about by the bequest and a purchase (from the proceeds of the first public lottery!) of Sir Hans Sloane's collection, the Museum's ethos has always been to maintain and enhance a globally important reference collection as well as providing accessibility to all. There have been many papers detailing the history of the Entomology collection since its inception (e.g., Hyatt 1975, Riley 1964, Scoble and Mendel 2009). These have concentrated on the collections, and the enhancement and use of them. In this paper, I will discuss the way that the new buildings at the NHM have not been built just for the collections, but also for increased public accessibility and science promotion.

Although originally having been structured on the premise of easy access for all to the collections, the accessibility of the Museum and the collections was not always easy, and some may argue still is not. When it comes to the Entomology Department, the processing, collecting, storing of the material and its accessibility have changed enormously since the beginning, in big change recently with the development of the Darwin Centre, especially the new Phase or DC2 (Figures 1 and 2).

The need for increased space was evident as we were still receiving many donations and visitors. Nowadays, primary acquisitions, through Museum fieldwork, range from about 1,000 to over 30,000 specimens per year (depending upon the groups). Secondary acquisitions, through donations, bequests, exchanges and purchases, also fluctuate widely year-on-year, ranging from fewer than 20,000 to over 200,000 a year. The annual average number of specimens added to the registered collections is 130,000.

At the moment in just the Diptera Section there are between three and five million specimens, although this is a guestimate. The collection comprises a pinned dry collection (divided into a World and a British Collection), a slide collection and a spirit collection. Who knows how much material is within the spirit collection? We are currently sorting the material from collections sampled up to fifty years ago that have been in our storerooms collecting dust.

For approximately the last sixty years the collections were housed in a separate Entomology building, a lofty building with the collections distributed across the floors with the associated curatorial staff (Figure 1). The collections themselves were housed in an assortment of drawers in many different styles of

---

* Based on the joint LNHS/BENHS Brad Ashby Memorial Lecture at the Natural History Museum on 14 September 2010.

426455-1001

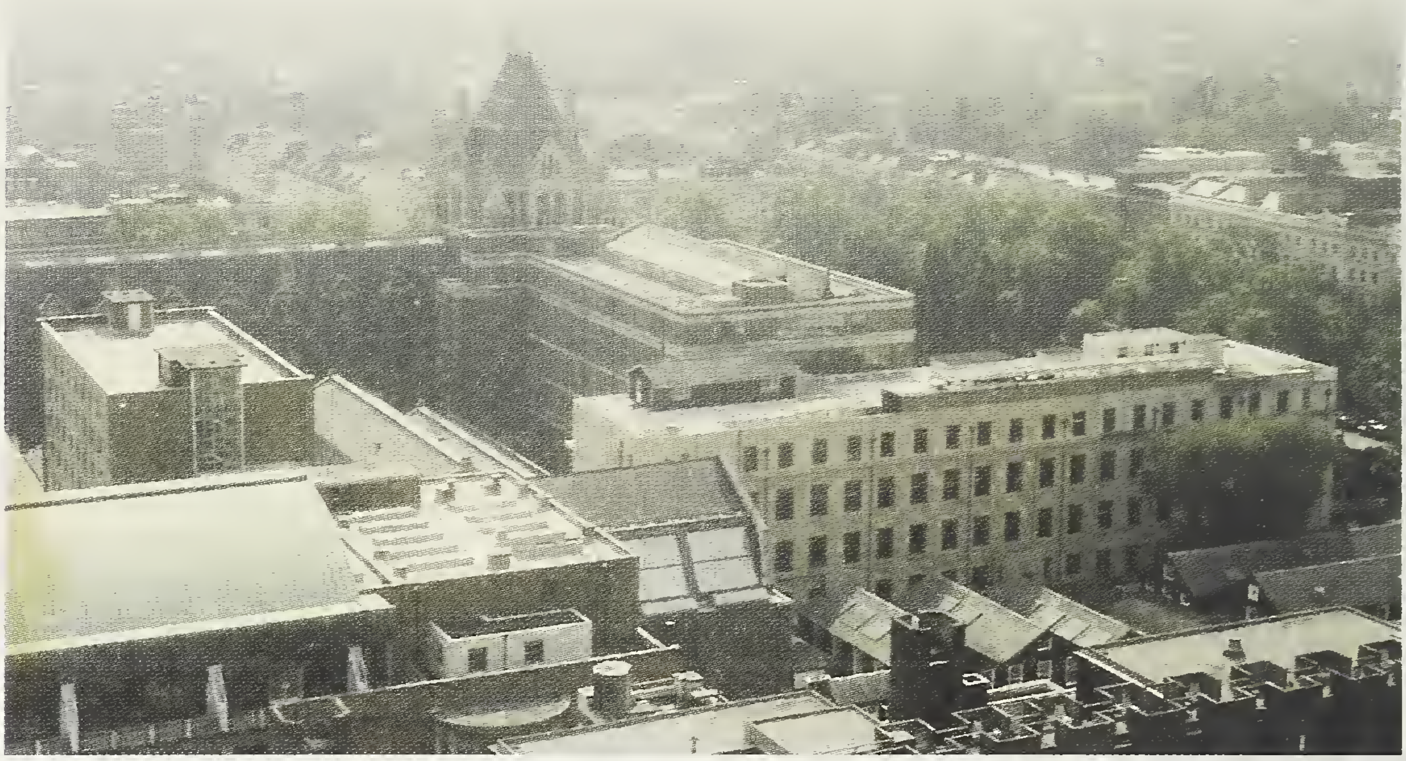


FIGURE 1. The original Entomology building (running back from the West Tower of the Waterhouse Building), and the many-windowed concrete Zoology Department's 1920s –1930s Spirit Building, both of which were demolished to enable the Darwin Centre Phase 2 to be built.

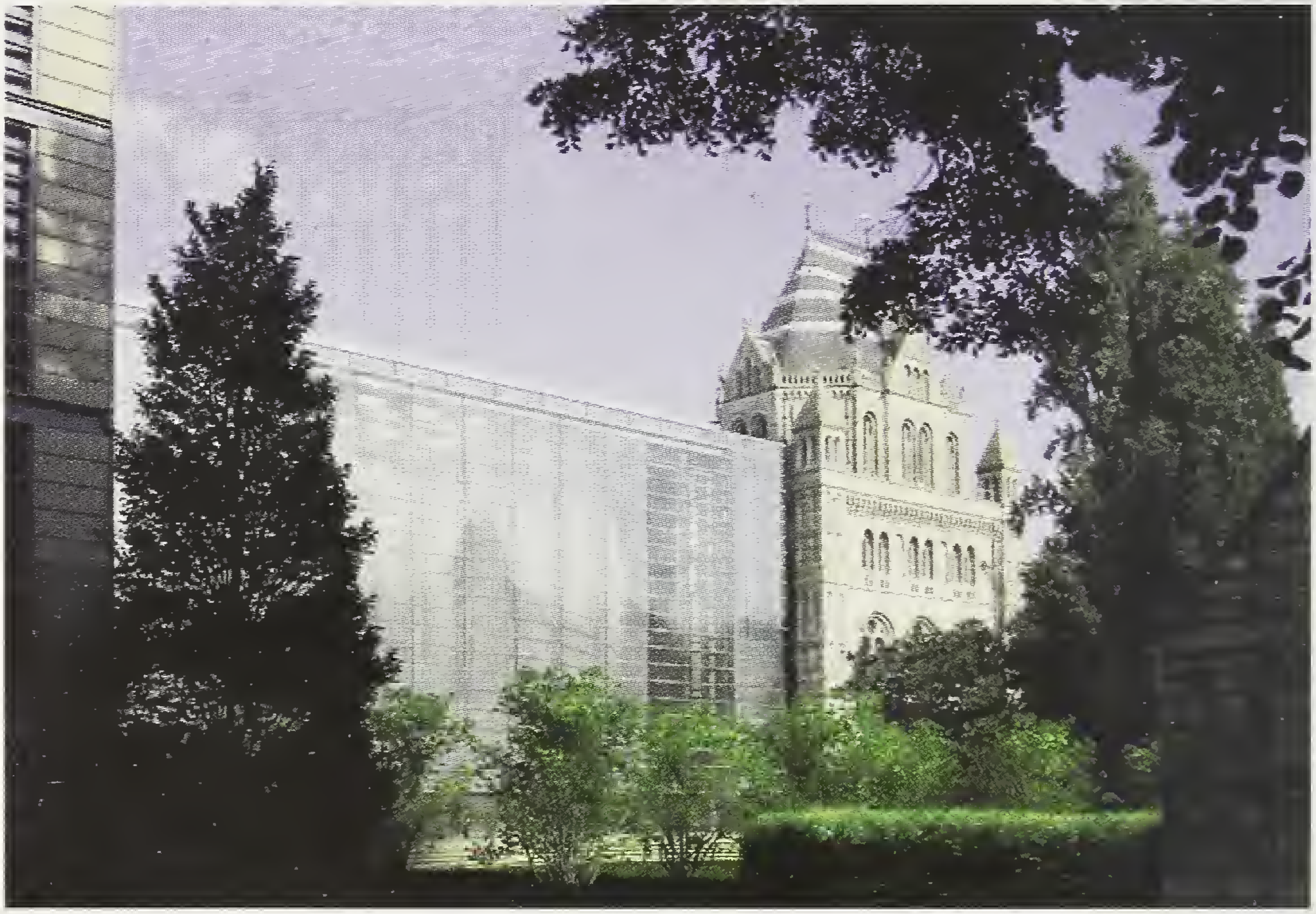


FIGURE 2. Darwin Centre Phase 2, with Phase 1 (far left) and the Waterhouse West Tower, centre right.

cabinets acquired throughout the life of the museum (Figure 3). This building was very good for the staff and visitors to the collection who like having the material close to them but it was limiting in many other ways: the collection conditions fluctuated a lot, pests were common, and all the work undertaken was away from the public eye, and so much of the entomological research that was undertaken at the Museum was unknown.

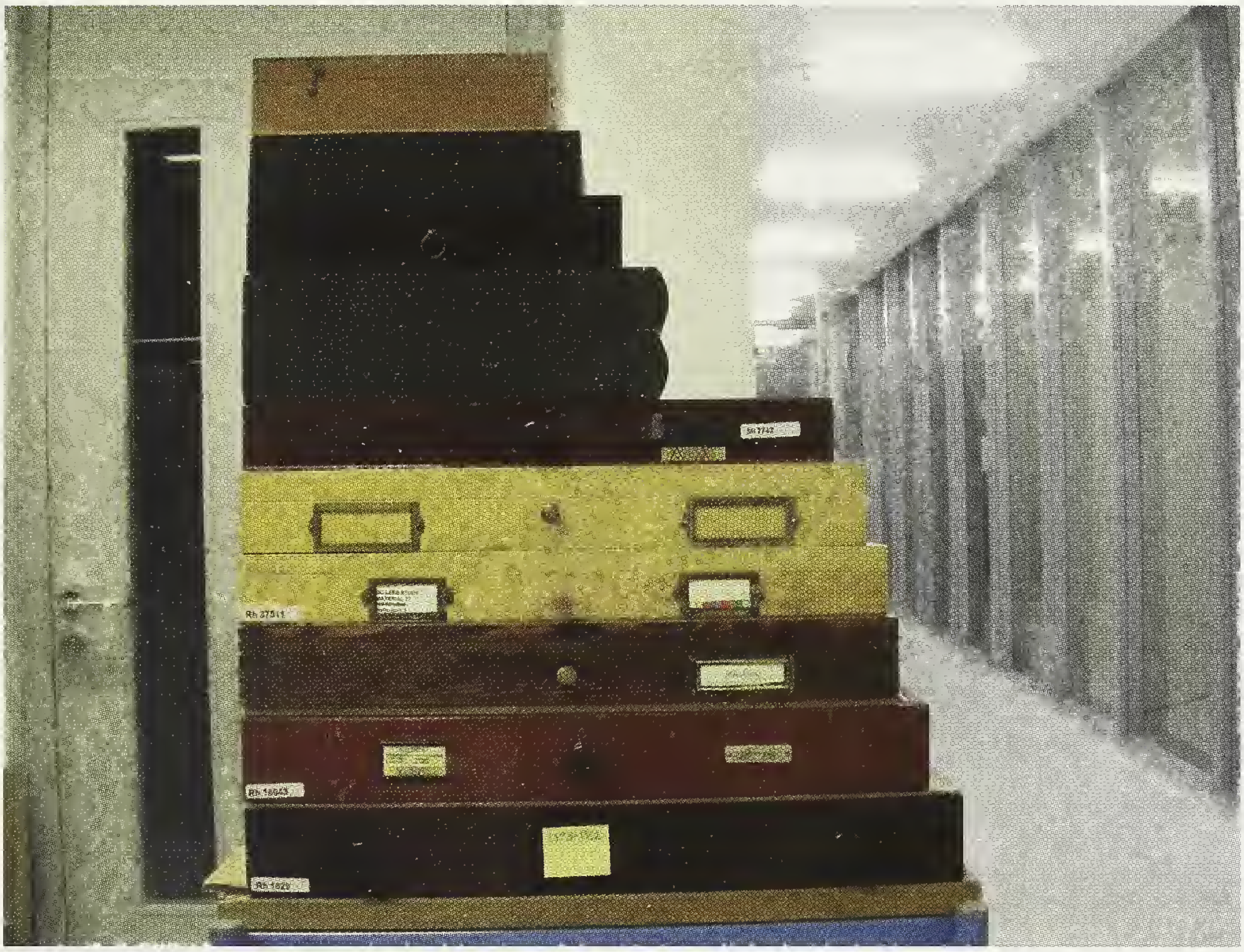


FIGURE 3. Examples of different entomological drawers.

A new building was therefore required, and it was designed with some specific premises in mind. The new building was to enable the museum

- to have high-quality storage facilities to protect the collections whilst promoting access to the holdings
- to build spacious and modern laboratories and working spaces for research, collections management and digitization
- to improve the wider understanding of the Entomology Department's science, both research on collections and specimens, and the wider topics that we study, including medical and forensic entomology.

The Museum's involvement with the wider amateur community and natural history societies had waned, with many of the professionals within the Museum becoming preoccupied with individual goals rather than the overarching museum-wide ethos of collection enhancement, and promotion of natural history and taxonomy. During the 1980s the Trustees of the Museum were all from business backgrounds, and many of the policies at that time reflected a more commercial approach to accessibility to collections which further alienated the wider communities. Societies were often charged for the use of facilities, and staff were not always available. For many years in the Entomology Department there was no complete separate British collection, even though many collections that had been donated were comprised solely of British material.

The idea of separate British collections was discussed many times and within certain groups this had been achieved. In Coleoptera, for example, the collections of Sharp, Power and Champion, as well as Donisthorpe (over 22,000 Coleoptera), were kept as separate collections, and were easily combined for a British Coleoptera Collection. Donisthorpe was described as many things including eccentric and overkeen, and had a propensity for naming new species after his mistresses, although most of these species were later synonymized! In the mid 1960s and '70s many of the larger groups had a separate British collection but there were many groups missing, and of the separated groups, the levels of maintenance varied.

When the first separate British collections were being developed, teams of volunteers were drafted in to help with the enormous task, and they have been used recently again for a very similar task. When the original British collections were being developed it was seen as an opportunity to recurate the collections to higher standards including transferring all of the material onto standard-sized pins and all specimens staged at the same height onto strips. Unsurprisingly, the results were varied with different groups achieving different curatorial levels and species completeness. Many of these were subsequently sunk back into the main collections much to the annoyance of British entomologists, but a few of the larger groups, including Coleoptera and Diptera, still maintained separate collections. Alongside the physical development of the new building the development of a complete British synoptic (or reference) collection was proposed.

The old Entomology building, completed in 1952 (Hyatt 1974) was demolished in 2005 and the Department spent the interim years in the former Origins Gallery of the Waterhouse building, in the Spence Gallery, as well as separate collection facilities at Wandsworth in south London. (The Origins Gallery was split into two floors with the collections residing underneath the staff workstations and workspace areas. This often resulted in very bouncy conditions for the staff depending where on the floor they were.) As throughout the Department's history, donations were still being received, including the Greathead Collection of Bombyliidae (beeflies) and Cadiou Lepidoptera Collection. The Lepidoptera collection itself moved into the warehouse facilities at Wandsworth. As with the other collections this interim period was used as a time to standardize and consolidate the collections. Lepidoptera had three separate main collections which was confusing and time-consuming for specimen location for visitors and staff alike. As well as consolidating the collection, the accession material was also to be transferred from drawers lined with slats into modern unit trays. Much of the accession material had been ignored at the end of the collections and was not very accessible for visitors.

Both Lepidoptera and Hymenoptera had such large accessions collections that staff were drafted in from all different divisions to aid the transfer of specimens. Many of the other divisions used this time as well to carry out complete condition surveys to establish the housing conditions (including shallow drawers, cork slats and plastic drawers), which were outdated and detrimental to the specimens.

The new building (DC2) was going up during this period and within it the development of the high-quality storage facilities within a Cocoon, staff working areas and specialized laboratories sitting alongside the Cocoon. Within this Cocoon there was the development of the remote sensor environmental monitoring systems which could maintain the collections at 17°C (+/- 2) and 45 per cent humidity (+/- 5). The cabinets were designed specifically for the Museum after much work from both the curators and the manufacturers to design the most pest-, fire- and flood-proof cabinets, whilst ensuring that the drawers ran smoothly to minimize mechanical damage (Figure 4).

A specialist removal firm was hired to move the collections into the new building, after consulting the curatorial staff about where every drawer was to be moved to. The move further offered an opportunity for the collections to be reorganized in keeping with changes in taxonomic arrangements. Most of the pinned collections were now in compactors, to conserve space and allow for expansion.

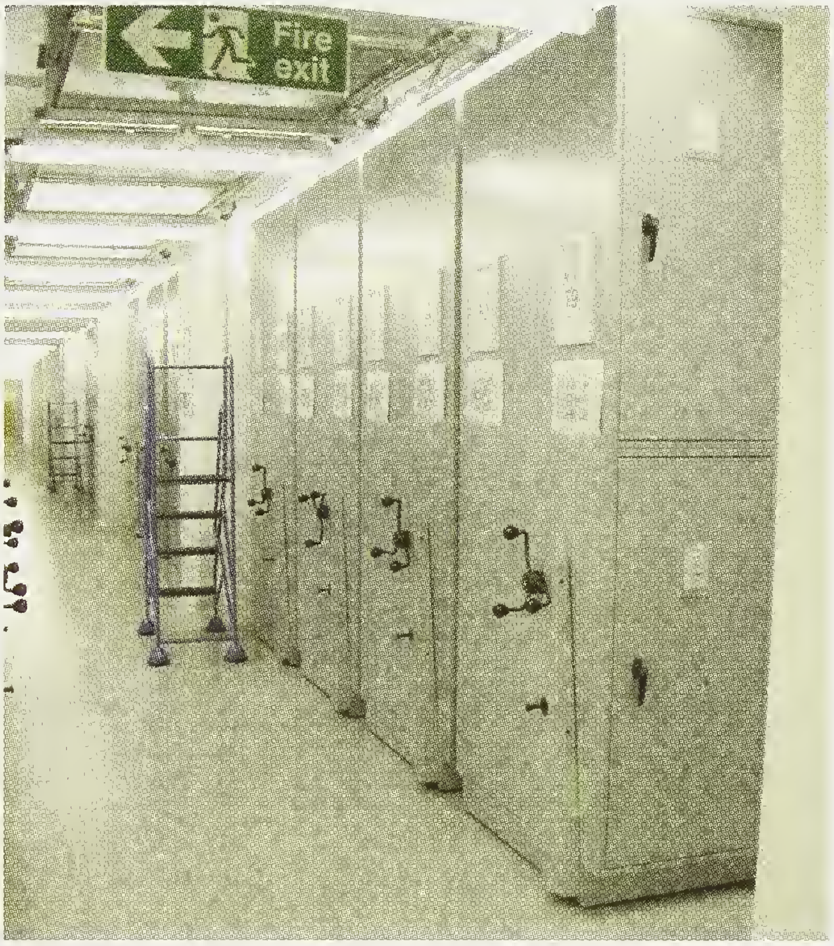


FIGURE 4. Inside the Cocoon — new entomological cabinets on compactors.

The collections are housed over seven floors, five floors for Entomology and two for part of the Botany collection. Not all of the collection moved in; Coleoptera and Hemiptera remained behind in the Origins Gallery but were moved into standardized drawers and cabinets.

There are new research and curation facilities, both within the Cocoon itself and alongside the main staffing areas. For example, the Diptera collection is housed next to a curatorial laboratory in a Cocoon end which offers a large space for the recuration, identification and use by amateur groups and natural history societies. As well as increasing the general public accessibility (viewing windows into the collection and specific laboratories), an aim of the new building was to increase the accessibility of the collections to groups and societies. The Dipterists' Forum held their AGM here in 2009 just after the building was opened, and the Cocoon space offered a large, brightly lit area, stocked with microscopes next to the British Collection, for individuals to compare their specimens with the National Collection. For the first time in a long while they were able to work together through the British collection, extract metadata to add to recording schemes, and as well as identifying their specimens. Corrections were also made to the British Collection; a benefit both to the Natural History Museum and the Dipterists' Forum. Up to twelve people are able to work in the collection at one time within Diptera but this can be greatly expanded for other groups such as Lepidoptera, the collection extending over four floors (Figure 5). More positive outcomes of these types of events for the Museum is that there are now several permanent volunteers who are both experienced dipterists who assist with recuration, as well as increased donations of material, as the wider community becomes aware of gaps within the collection. Through conducting a recent collection survey which recorded the number of specimens per species held in the collection, a complete list of the British Diptera held at the Museum, and the gaps within it, is now available and posted on the Dipterists' Forum web page.

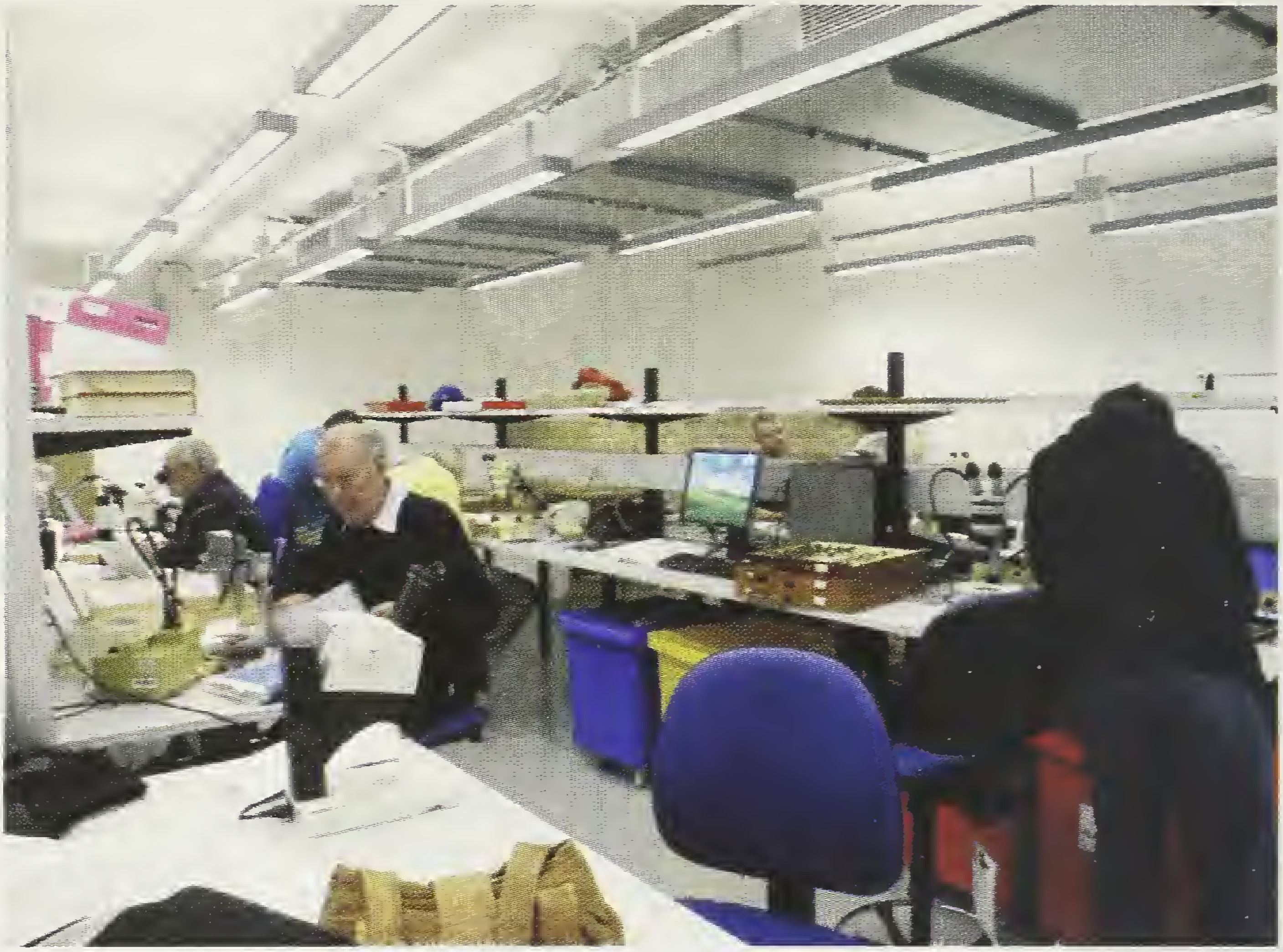


FIGURE 5. The Dipterists' Forum hard at work in the Cocoon end.

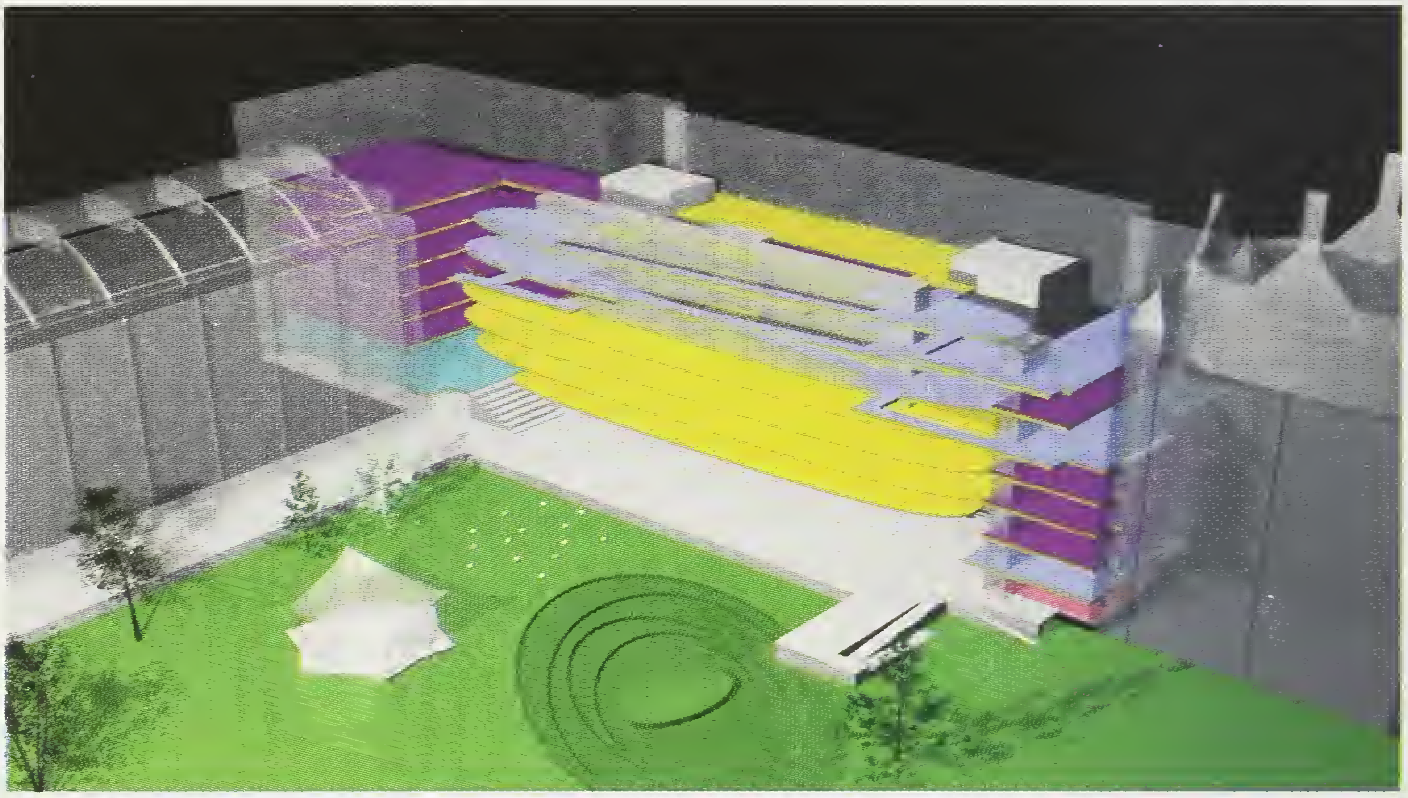


FIGURE 6. The Darwin Centre Phase 2. The explore tour (blue) winds around the collection space (yellow) which is surrounded on each side by offices and laboratories (purple) into which the public can view.

As well as spaces within the Cocoon, there are individual divisional laboratories alongside the staff working areas for wet material (Malaise trap samples, slide preparations, spirit collections). Before moving into the new building there was limited space in the interim for volunteers working on specific projects, such as sorting wet material. Volunteers are now able to work in a localized space, conducive to group working, and are processing many old samples of mixed insects. This is of enormous benefit to the Museum and also to the volunteers themselves as it provides a unique opportunity to gain greater identification skills with different entomological groups from many different regions across the globe.

As already stated, the building itself offers a much greater public visibility of NHM science. The public are able to explore the outside as well as the inside of the Cocoon. A walkway within the Cocoon includes windows that look into the molecular, digitizing and plant-pressing laboratories (Figure 6). Within the 'Explore Tour', the public are able to walk along at their own pace viewing films of the Museum scientists on screens which guide and inform the public on the research and collections. The NHM is able to demonstrate the value and necessity of the huge scientific collections housed here, highlighting the research undertaken behind the scenes.

There is also a specimen preparation area (SPA), which is manned by 'scientists'. For two-hour periods, a staff member works within this area and can be seen, and interacted with, via a telecommunications system. This offers a fantastic opportunity for the staff to communicate the research or curation that they are undertaking, as well as the overarching science strategy of the Museum. Many aspects of Museum science have been undertaken in the SPA including slide preparation, insect sorting and micro-Hymenoptera identification. The reaction from the public has been exceptionally positive from individuals to groups of school children having the opportunity to quiz a member of staff on subjects ranging from collecting to pinning and how these relate to the wider scientific questions.

This is one of the many ways that this building has enabled the NHM to increase public awareness of the role it has in terms of collections care and scientific research. The Darwin Centre is helping to change the perception of the Museum from a static collection hidden away with little relevance staffed by the obligatory bearded curator or researcher (albeit there are many!) to one that is relevant in terms of answering questions on biodiversity and climate change, as well as encouraging the wider public to engage in their local, national and international environments. We are now showing that museums are a dynamic environment with the staff still actively working on discovering and describing new species with traditional morphological methods as well as with new molecular techniques such as DNA sequencing. We are also highlighting that the Museum is not working independently but collaborating with other researchers and institutions both nationally and internationally.

There is a tendency for reports on biodiversity to focus, quite naturally, on species loss. This has left many individuals believing there is very little that can be done in combating this. By highlighting the research, showing our collecting programmes and how we participate in recording schemes, we can emphasize that in fact there is still much to learn about the species composition of our local, national and international environments and how this can be used to combat species loss.

The other new part of the building is the Angela Marmont Centre for UK Biodiversity (Figure 7), and this is of more importance to the British collectors, societies and general visitors with a special interest in UK biodiversity. It is here the newly developed synoptic (reference) collections are housed and these are accessible whenever the Museum is open and is freely available for all to use. There is also an enquiry service run from here, which includes the Insect Identification Service, which answers the most common enquiries or passes them on to the most appropriate curator or researcher. The Centre provides a space for societies where members have an interest in UK biodiversity as well as providing facilities for teaching courses (recent courses have included Introduction to Insects and Beginner's Hoverfly Identification).

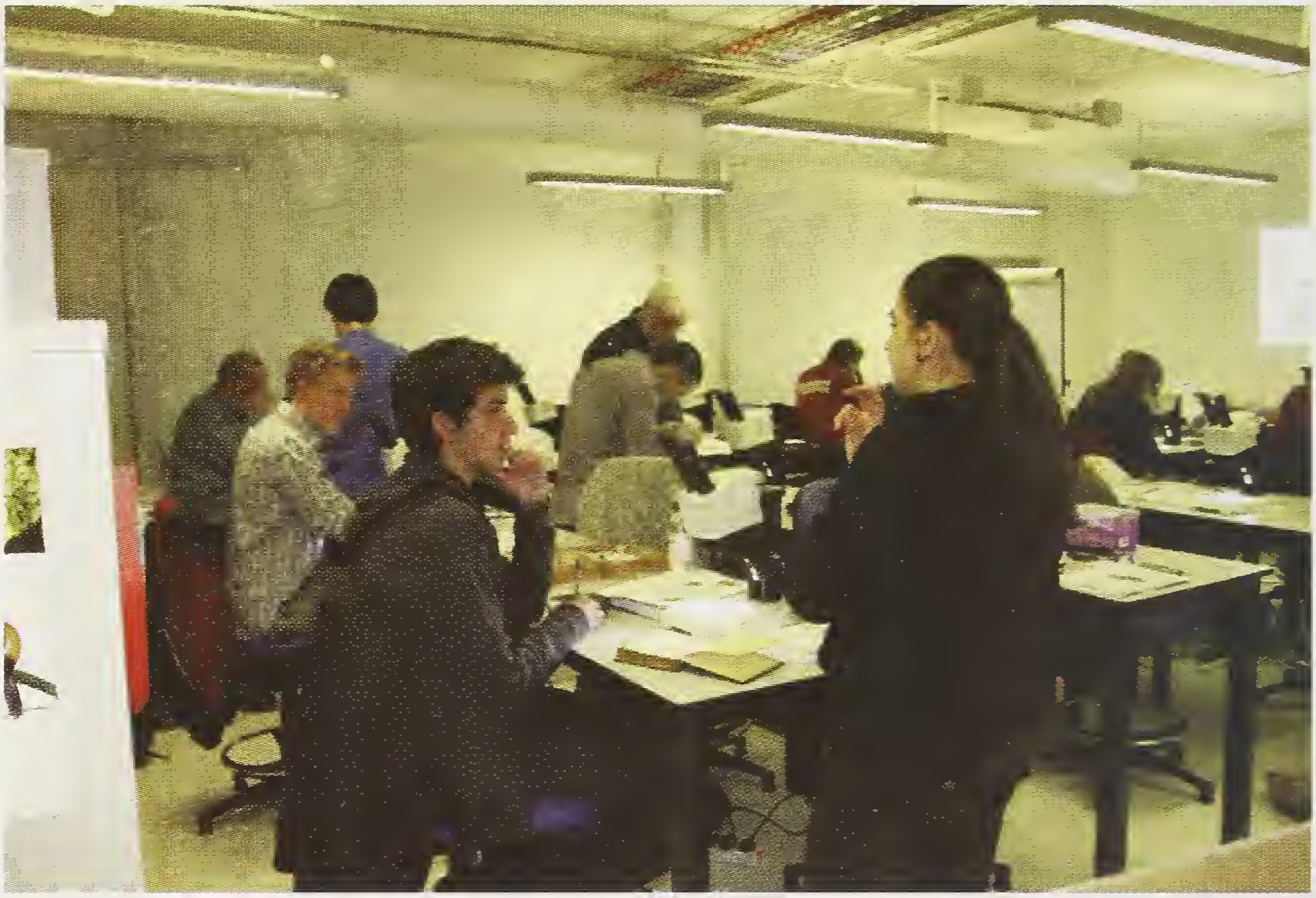


FIGURE 7. The Angela Marmont Centre for UK Biodiversity. The picture shows part of the Centre in which courses can be run (here an Introduction to Hoverflies).

All of this increased public outreach has implications for both the staff and the public. Staff are becoming more visible to the public and this has a impact on staff time. But the impact of this increased visibility, both academically (with increased donations and visitors) and culturally (encouraging more citizen science) is of such value for the NHM and the general understanding of biodiversity, that it is essential to maintain this level of interaction.

The Entomology collection has come a long way in the last forty years. From being hidden behind closed doors with restricted access, through periods of good (and bad) management, to the present, and we hope, to an era of increased accessibility with open access synoptic collections and large, spacious, working environments next to the Main and British Collections. The collections have gone from mixed housed, non-standard drawers to enclosed cabinets with standardized drawers and unit trays, to protect and maintain them.

By fostering greater links with the amateur groups and natural history societies, the Museum is both able to contribute to them by providing data on, for example, species distribution patterns due to the age and breadth of the collections, and benefit from the societies by being able to maintain and enhance the collections through donations and collaborations. A rewarding outcome for all.

References

HYATT, K. H. 1974. The story of the Natural History Museum. *Lond. Nat.* **53**: 7–16.

HYATT, K. H. 1975. The collections of the Natural History Museum. *Lond. Nat.* **54**: 6–10.

RILEY, N. D. 1964. *The Department of Entomology of the British Museum (Natural History) 1904–1964. A brief historical sketch.* The XIIth International Congress of Entomology, London, 1964, 48 pp.

SCOBLE, M. J. and MENDEL, H. 2009. The entomology collections at the Natural History Museum, London. *Antenna* **33**(1): 19–26.

Coppicing Haringey's ancient woodlands

DAVID BEVAN
3 Queen's Road, London N11 2QJ
conserving.bevan@virgin.net

Abstract 55
Introduction 55
The woods — Coldfall Wood 55
The woods — Queen's Wood 56
The coppices — Coldfall Wood 57
The coppices — Queen's Wood 57
The coppice floras 59
Discussion 66
Acknowledgements 69
References 69
Table 1 — Presence/absence of vascular plants and ferns in Coldfall Wood Coppice.... 70
Table 2 — Presence/absence of vascular plants and ferns in Queen's Wood Coppice.... 77

Abstract

Recent coppice projects carried out in two north London woods (Coldfall Wood and Queen's Wood in Haringey) are described. Changes to the coppice floras have been monitored and the results are discussed.

Introduction

Coldfall Wood and Queen's Wood are two ancient oak/hornbeam woodlands lying near the western edge of the London Borough of Haringey (Figure 1). Both have a long recorded history of traditional coppice management dating back to the first half of the seventeenth century. Silvertown (1978) gives a useful account of the woods' early histories; Game (2000) prepared detailed Management Briefs for both woods; and Bevan (1986, 1992), Gilbert and Bevan (1997) and Graham-Brown (2006) cover aspects of the woods' ecologies.

The woods

Coldfall Wood (TQ 276 903) is a fourteen-hectare woodland lying on London Clay with some overlying glacial gravel along the western boundary. A stream, Coppetts Brook (known locally as Coldfall Wood Brook), runs from south to north through the centre of the wood. Previously culverted near the middle of the wood, this part of the stream was brought to the surface in 1998 to rejoin its original natural course. A substantial wood-bank with a ditch on its outer side runs along the western and northern boundaries. In historical times this would have protected the coppice from animals grazing on what was once a part of Finchley Common. Ring counts of the recently cut hornbeams indicate that the wood was last coppiced in the 1930s and the hornbeams have the multi-stemmed appearance characteristic of such woodland. Before the current coppicing programme was initiated in 1990, the interior of the wood was very shady in the summer owing to the dense canopy of hornbeam. As a consequence the ground flora was sparse. A botanical survey carried out between August 1985 and August 1986 (Bevan 1986) found a total of just 128 species of flowering plants and ferns, but nearly half (54) of these only occurred around the edges of the wood. The list included eighteen ancient woodland indicator species (Rose 1999). One of these, common cow-wheat *Melampyrum pratense*, has the dubious distinction of being the only plant from the 1985/86 survey that was not refound in Coldfall Wood during the current coppice project. It remains widespread in Queen's

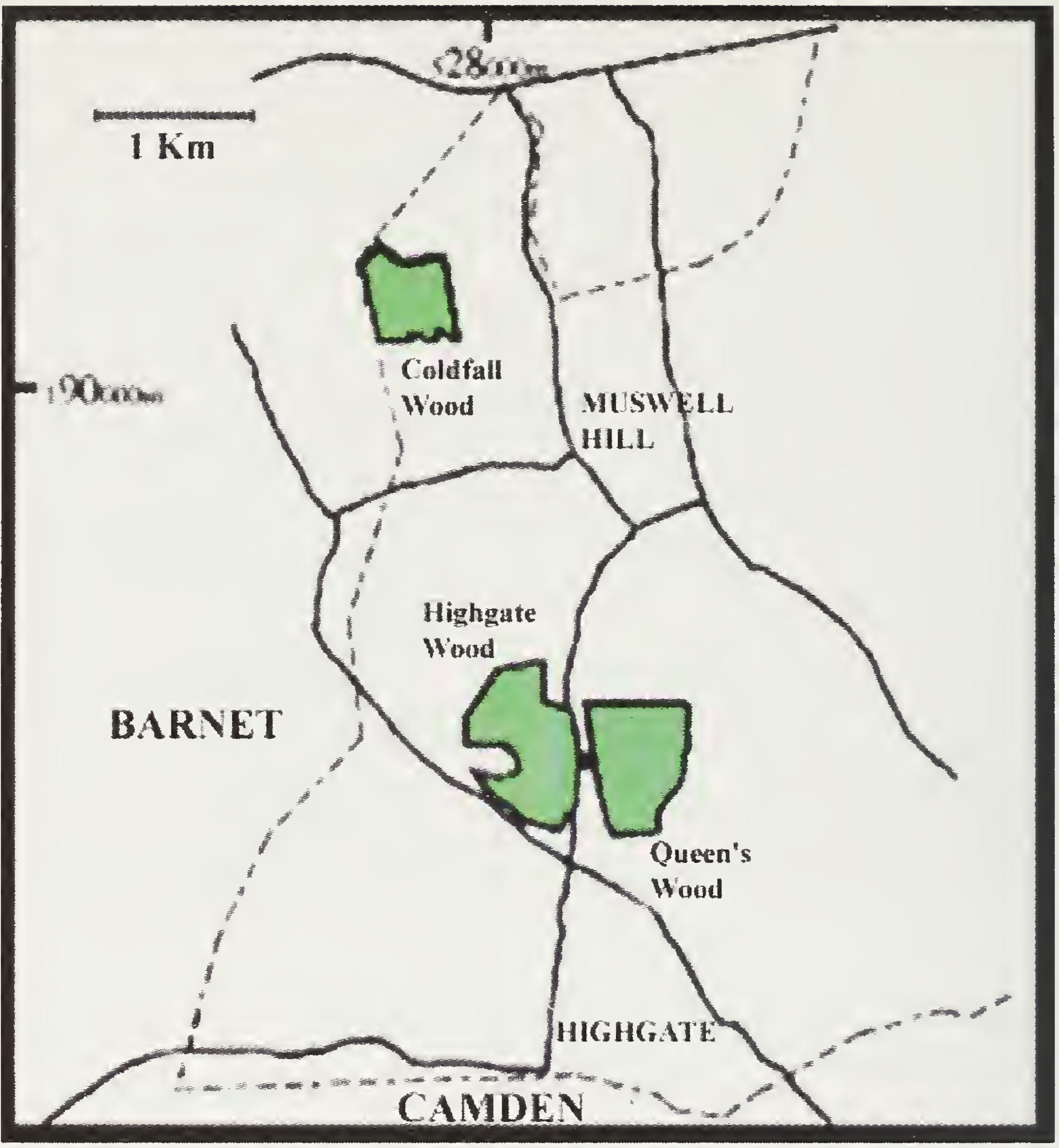


FIGURE 1. West Haringey, showing location of woods. Broken line, borough boundary, solid lines, major roads.

Wood. The canopy in Coldfall Wood is dominated by English oak *Quercus robur* and hornbeam *Carpinus betulus*, together with frequent silver birch *Betula pendula* and occasional mountain ash *Sorbus aucuparia*, elder *Sambucus nigra*, holly *Ilex aquifolium*, downy birch *Betula pubescens* and wild cherry *Prunus avium*. Small quantities of Midland hawthorn *Crataegus laevigata*, common hawthorn *C. monogyna* and the hybrid between them *C.* × *media* are found, but other trees, including wild service *Sorbus torminalis*, field maple *Acer campestre*, sessile oak *Quercus petraea*, crab apple *Malus sylvestris*, hazel *Corylus avellana*, ash *Fraxinus excelsior* and beech *Fagus sylvatica* are all rare. Further botanical records were kept of the plants appearing in three small coppices cut between 1990 and 1994 (Gilbert and Bevan 1997). In the dampest of these, plentiful goat willow *Salix caprea* has established, but this tree was rare elsewhere in the wood until the recent stream coppice has enabled it to establish in some quantity.

Queen's Wood (TQ 288 886) is a twenty-one hectare statutory Local Nature Reserve (declared by the London Borough of Haringey in 1990). It also lies on London Clay, but this grades into the Claygate Beds on the higher ground. The topography is more varied than in Coldfall Wood and includes a steep-sided central valley, which at one time contained a stream. This stream, shown on the Ordnance Survey 1:2,500 edition of 1894–96, forms one of the headwaters of the River Moselle, but was culverted in the early part of the twentieth century. Its former course is marked by a drainage ditch in the western half of the valley that supports a range of damp-loving plants, including thin-spiked wood-sedge *Carex strigosa* in one of its very few remaining Middlesex sites. In the centre of the valley, a large 'wildlife' pond was created in 2010 on the site of a former paddling pool. Another drainage ditch runs from the north-western corner of the wood and joins the culvert at the western end of the 2009 coppice at the site of a former dog pond (shown on the 1935 Ordnance Survey map). This part of the coppice remains permanently damp and supports a number of interesting wetland plants. Part of the western boundary of the wood is demarcated by a similar ancient wood-bank and ditch to that found in Coldfall Wood. Unlike that wood however, there is little visual evidence of previous coppice management, but Queen's Wood is known to have been regularly cut until the mid nineteenth century (Silvertown 1978). The mature hornbeams have grown to a great size in many parts of the wood, including the current coppice site, and some of the largest are around 150 years old. A small, experimental coppice (*c.*¼ hectare) was cut in the western half of the wood in February 1992 and is referred to in the discussion below.

The interior of Queen's Wood is more open than in Coldfall Wood and the flora is consequently more diverse. The canopy is also dominated by English oak and hornbeam, but the tree flora is more varied with plentiful beech and sessile oak on the higher ground. Silver birch, downy birch, holly (including much Highclere holly *Ilex* × *altaclerensis)*, mountain ash, hazel, elder, wild cherry, the two native hawthorns and their hybrid, ash and field maple are all frequent. Wild service tree is widespread in the eastern half and there are occasional mature goat willows. Large-leaved lime *Tilia platyphyllos* is regenerating freely from planted trees along the southern border.

In 2006, the Friends of Queen's Wood commissioned the author to carry out a botanical survey of the wood. This was undertaken during 2007, and provides a 'snapshot' of the flowering plants and ferns found in that year: 225 species were recorded. In addition, following an extensive literature search, the flora includes a wide range of earlier botanical records from the wood extending back to the seventeenth century. These historical records added a further 140 species to the total (Bevan 2010).

The coppices

In **Coldfall Wood**, mature hornbeams were coppiced along a strip of approximately ten metres width on either side of the central stream in December 2006, covering an area of about one hectare. The area included some marshland to the north, known locally as the 'everglades marsh', where several hornbeams had recently died because of the regular flooding of the stream. The coppiced hornbeams were cut into manageable lengths and stacked away from the stream. The work was funded by the Heritage Lottery Fund (HLF), as part of the wider Capital Woodlands Project overseen by Trees for Cities and locally in partnership with Haringey Council. HLF also paid for the construction of two wooden bridges over the stream and for the creation of two small reedbeds at the stream's southern end. These were planted with a range of aquatic species (marked with a P in Table 1) designed to intercept any pollutants entering the stream from the catchment area lying to the south. Changes to the flora were regularly monitored (with visits every month between April and September) from the year before the coppice was cut (2006) and throughout the following five years. The plants recorded in each year are listed in Table 1.

In **Queen's Wood**, a coppice of about half a hectare was created in February 2009 by felling the mature hornbeams at the eastern end of the central valley. The work was funded by the SITA Trust and Haringey Council's 'Making the Difference' grant following applications by the Friends of Queen's Wood. In order to protect plants growing within this coppice, a dead-hedge was built around the perimeter using brushwood from the felled hornbeams. The cut hornbeams were stacked and secured with metal bands. As in Coldfall Wood, the flora was regularly monitored during the year before the coppice was cut (2008) and throughout the following three years. Figure 2 shows the coppice area in February 2009, looking east from the dog pond, just before the coppice was cut. Figure 3 shows the same view taken seven months later (24 September 2009) after the coppice was cut. The plants recorded are listed in Table 2.

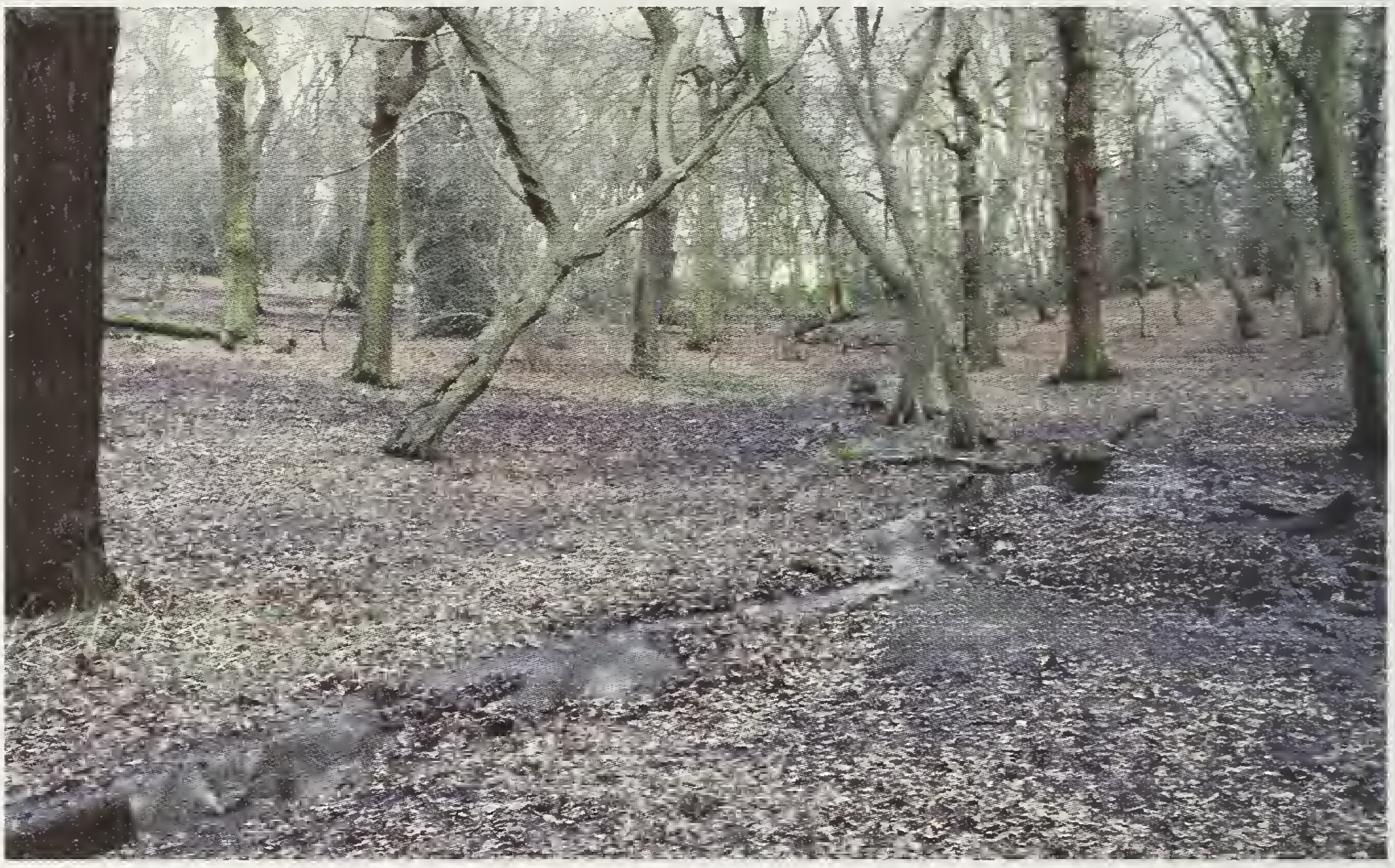


FIGURE 2. Queen's Wood on 11 February 2009 (just before the coppice was cut). View from the dog pond area looking east.

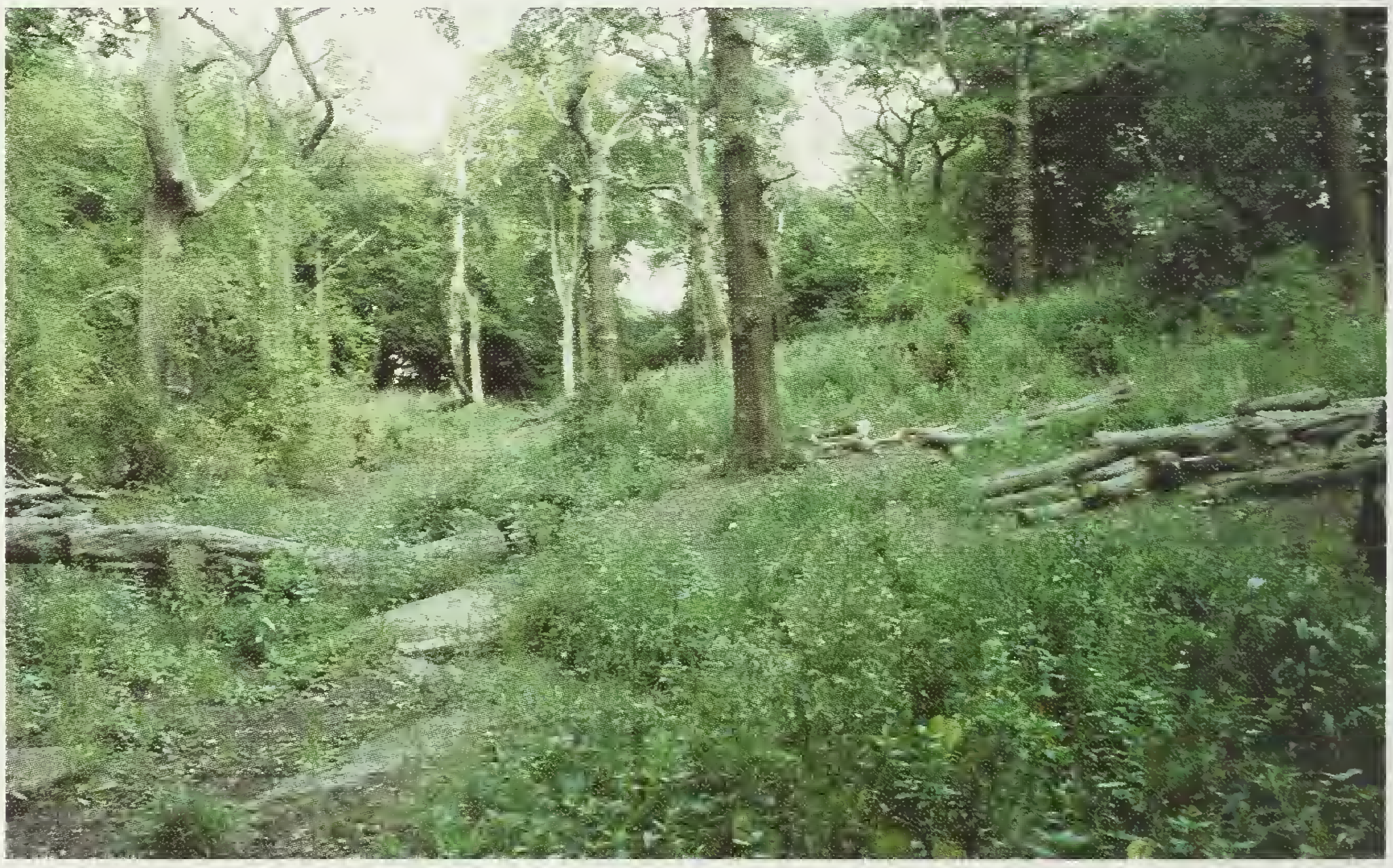


FIGURE 3. Queen's Wood on 24 September 2009 (seven months after the coppice was cut). The same view as in Figure 2.

The coppice floras

In both woods, the flora was very sparse in the year prior to coppicing, owing to the density of the hornbeam canopy and the resulting low light levels. More than 80 per cent of the coppice area in **Coldfall Wood** consisted of bare ground, and most of the limited vegetation was confined to the steep-sided banks of the stream. Three common species of fern grew here: hart's-tongue *Phyllitis scolopendrium*, male fern *Dryopteris filix-mas*, and broad buckler-fern *D. dilatata*. These had all been seen in the 1985/86 survey but a fourth species, soft shield-fern *Polystichum setiferum*, was a recent arrival. It appears to be spreading locally, though it is still a scarce plant in Middlesex (Kent 2000). A few fronds of lady fern *Athyrium filix-femina* were recorded in 2008 and may have been overlooked prior to coppicing. Bracken *Pteridium aquilinum* was frequent along the eastern edge of the coppice. Stunted plants of tutsan *Hypericum androsaemum* (Figure 4), absent from the 1985/86 survey, were scattered along the length of the stream. Tutsan was widespread as a native plant in the county until the late eighteenth century, and known earlier to the London apothecary James Petiver (*c.*1658–1718) 'in the woods about Hampstead and Highgate' (Petiver 1695). It is now thought to be extinct as a native in the vice-county and these plants are likely to have escaped from local gardens (Kent 1975). Also absent in 1986, was the single primrose *Primula vulgaris*, of unknown provenance, which grew rather precariously on the stream bank. Once widespread in woods in Middlesex, primroses are now rarely seen as most have been grubbed up and transferred to gardens. A small colony of fringecups *Tellima grandiflora* (Figure 5) also grew on the stream bank, the first of several exotic garden escapes to become established in the coppice.

In **Queen's Wood** the pre-coppice vegetation was even sparser, with around 90 per cent of the coppice area being bare ground, and only a thin scattering of plants along the boundary paths. There were no ferns. As in Coldfall Wood,

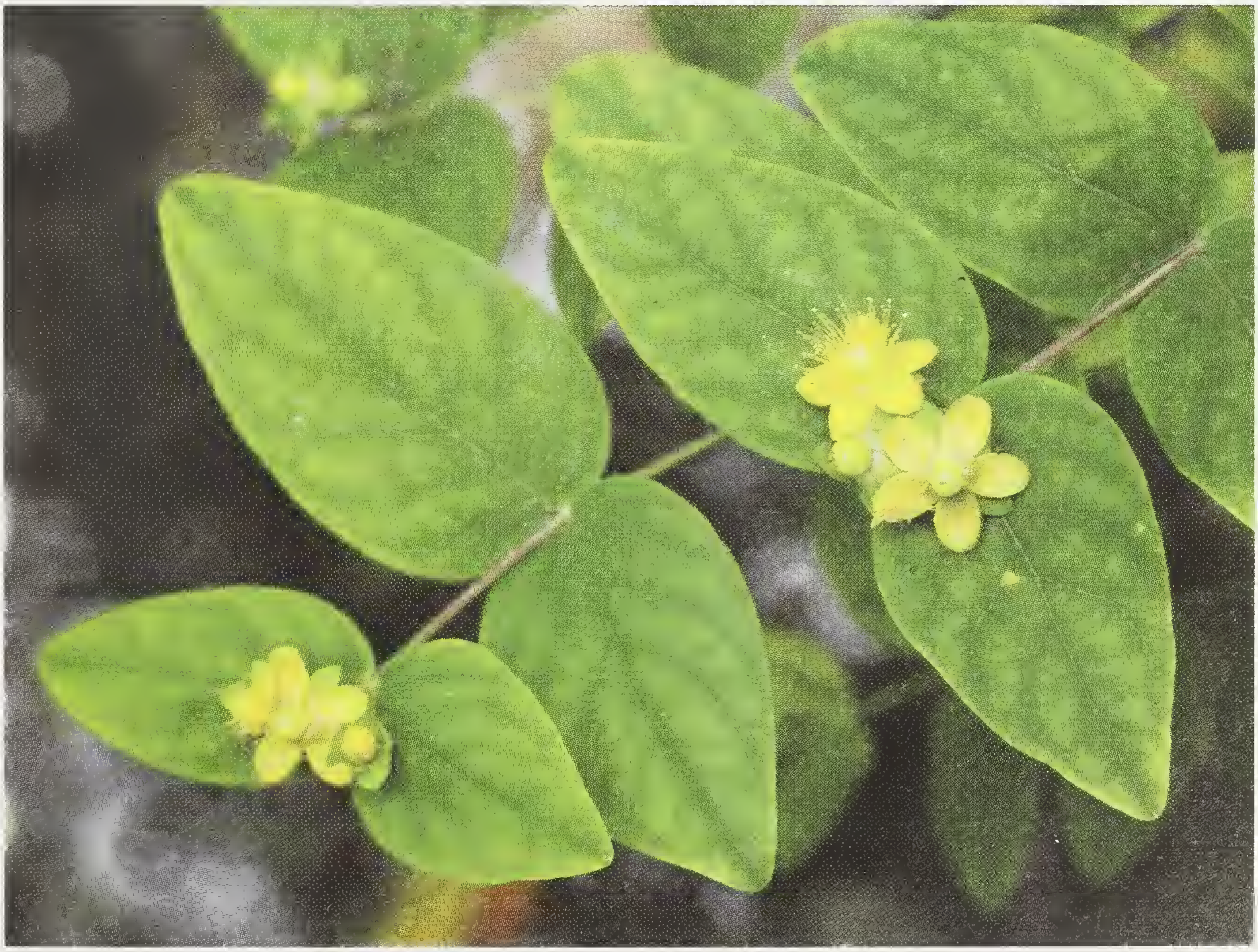


FIGURE 4. Tutsan *Hypericum androsaemum*.

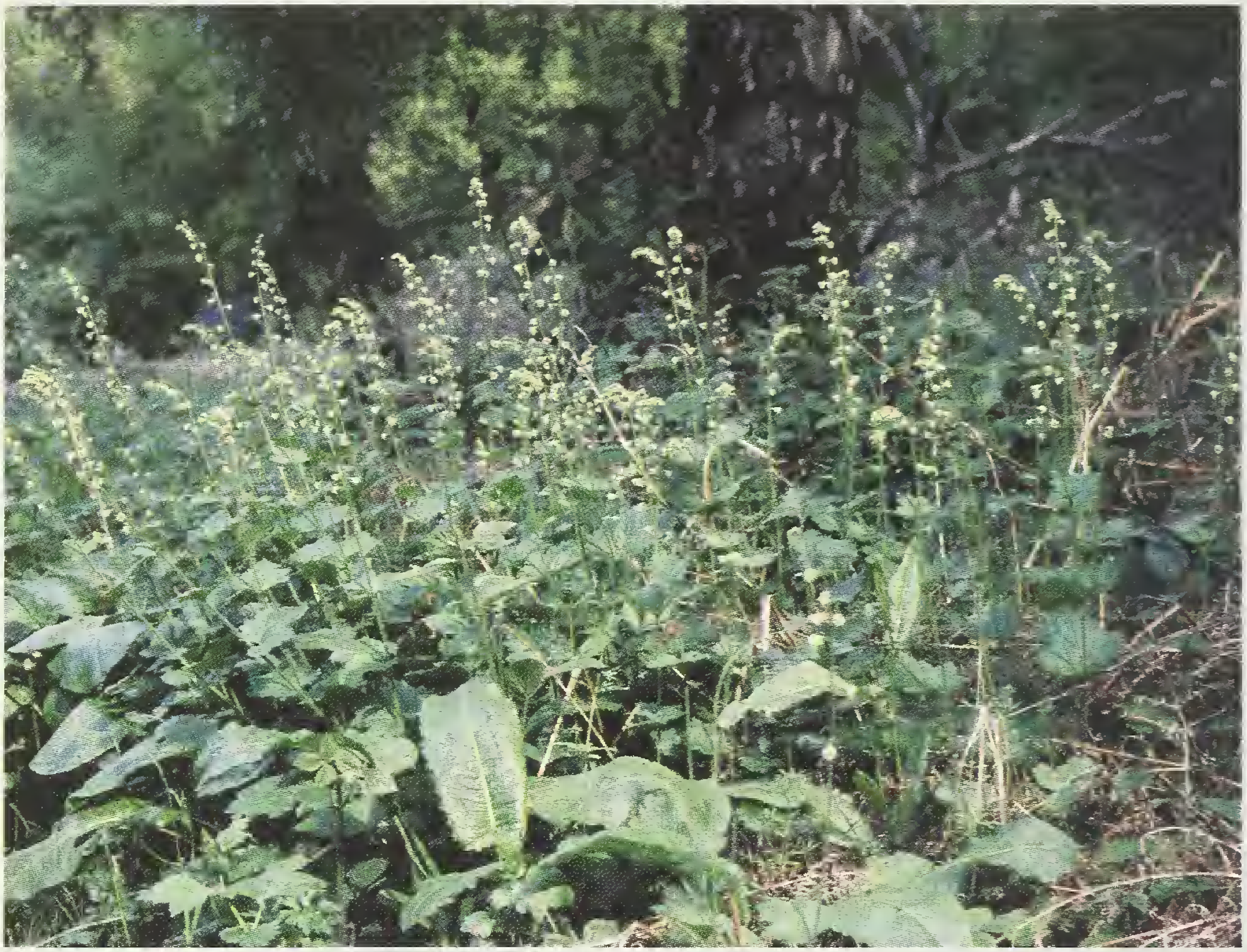


FIGURE 5. Fringecups *Tellima grandiflora.*

a few vegetative tufts of tutsan grew in dense shade. A single spike of broad-leaved helleborine *Epipactis helleborine* was found near the centre of the area to be coppiced. By the end of the first year after coppicing, eleven flowering spikes had been seen, five were counted in the following year and just two appeared in the third year as little suitably open habitat remained. This orchid was first recorded from the wood in 1956 by LNHS member Ted Bangerter (Kent 1975) and is now seen in low numbers along the central valley in most years (a maximum of twenty-two flowering spikes were seen in 2011). Wood anemone *Anemone nemorosa* occurs in scattered clumps in both coppices. The largest clump in Queen's Wood had twenty-seven flowers in April 2009, soon after the coppice was cut. By April 2010, this clump had produced almost 400 flowers.

In both Woods, the greatest numbers of new arrivals were seen during the first year after the coppice was cut. Around a hundred new species were found in each coppice during this year. Many annuals thrived in the well-lit bare ground. These included common native plants like the two orache species *Atriplex prostrata* and *A. patula*, two goosefoots *Chenopodium album* and *C. polyspermum*, thale cress *Arabidopsis thaliana*, and petty spurge *Euphorbia peplus*. More surprisingly, a small colony of common whitlowgrass *Erophila verna*, rare and decreasing in Middlesex (Kent 1975) turned up in Coldfall Wood. These, and other similar plants, declined rapidly in subsequent years as succession deprived them of suitably open habitat. In Coldfall Wood, a few plants of the Chinese gooseberry (Kiwi fruit) *Actinidia chinensis* var. *deliciosa* appeared briefly in the first year. This exotic fruit is seldom recorded in the wild in Britain and was a first record for Middlesex. It may have arrived as a result of sewage contamination of the stream — tomato *Solanum lycopersicum* seedlings were also recorded close by.

Longer-lasting biennial and perennial species also appeared early, including many that are known to survive for long periods as buried seed (listed in the Tables). They included foxglove *Digitalis purpurea,* which appeared in small quantities in both coppices, and slender St John's-wort *Hypericum pulchrum* (Figure 6). The latter, an ancient woodland indicator (Rose 1999), is now a rare plant in Middlesex (Kent 2000), but can persist in the seed-bank for up to 200 years (Buckley 1992). It was widely scattered in the Coldfall Wood coppice, but only two plants have been found in the coppice in Queen's Wood. It was also seen briefly (1993–1996) in the small experimental coppice cut in this wood in 1992. The closely related square-stemmed St John's-wort *Hypericum tetrapterum,* which can also survive for long periods as buried seed, was found in small numbers in both coppices. A damp-loving plant, it occurs near the stream in Coldfall Wood and in the poorly drained western end of the Queen's Wood coppice, close to the dog pond. Another seed bank specialist that appeared in the Queen's Wood coppice is heath groundsel *Senecio sylvaticus,* a new record for the wood of another plant that is declining in Middlesex (Kent 2000). Although not seen in the current stream coppice in Coldfall Wood, it was recorded from that Wood in an earlier 1990 coppice (Bevan 1992). Several sedges, also known to form persistent seed-banks (Grime et al. 2007), appeared in both coppices, although Coldfall Wood supported the greater number. Here, several populations of pale sedge *Carex pallescens* (Figure 7) were found in 2007 and were still present, though declining in numbers, in 2011. Three plants of common yellow sedge *C. demissa* (Figure 8) appeared on the stream bank in 2009 and are surviving, and a few plants of pill sedge *Carex pilulifera* were seen in 2008. Only the latter was recorded in the 1985/86 survey and all are now very scarce in Middlesex (Kent 1975, 2000). Bristle club-rush *Isolepis setacea,* another member of the sedge family that is rare in the vice-county, was found in some quantity beside the

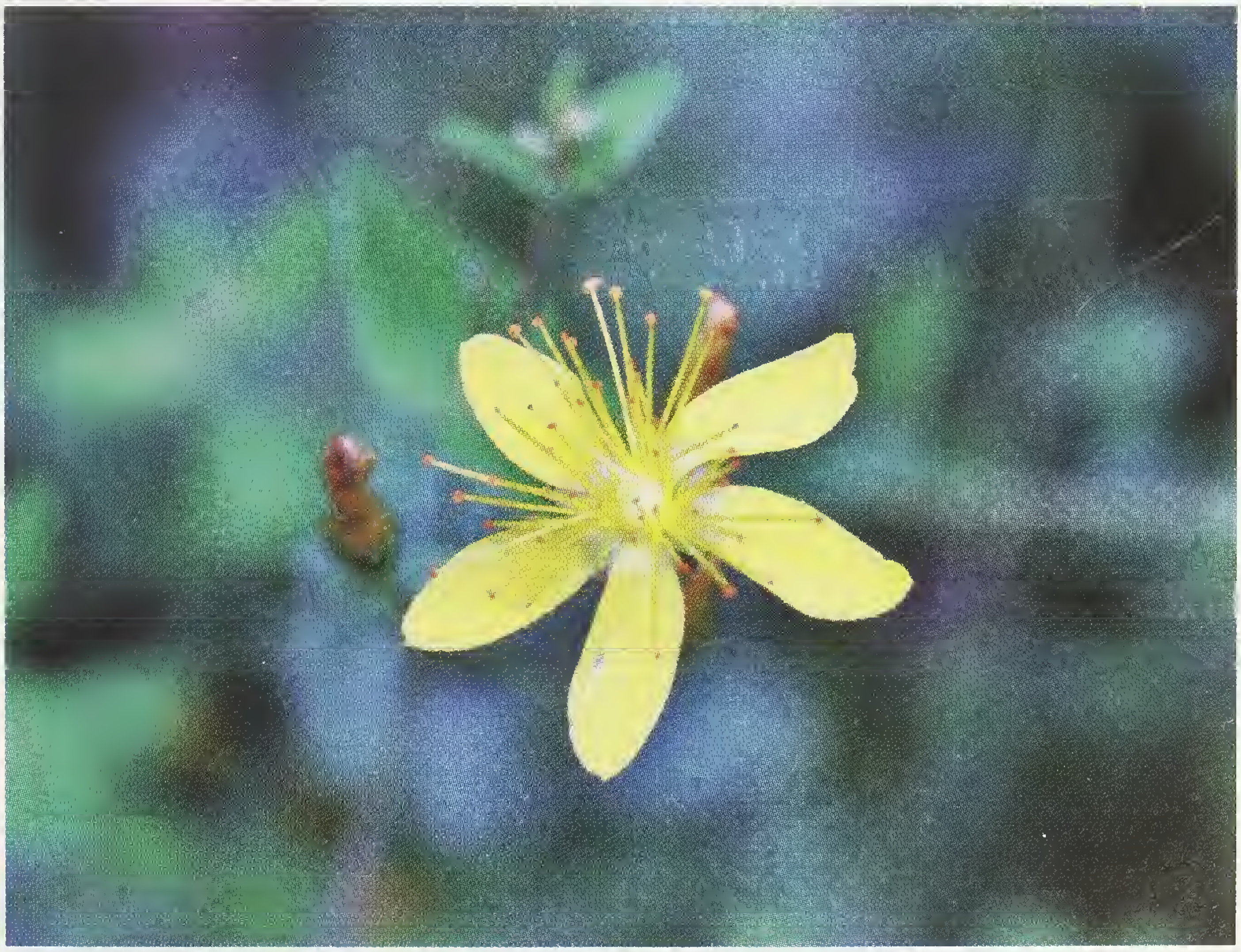


FIGURE 6. Slender St John's-wort *Hypericum pulchrum.*

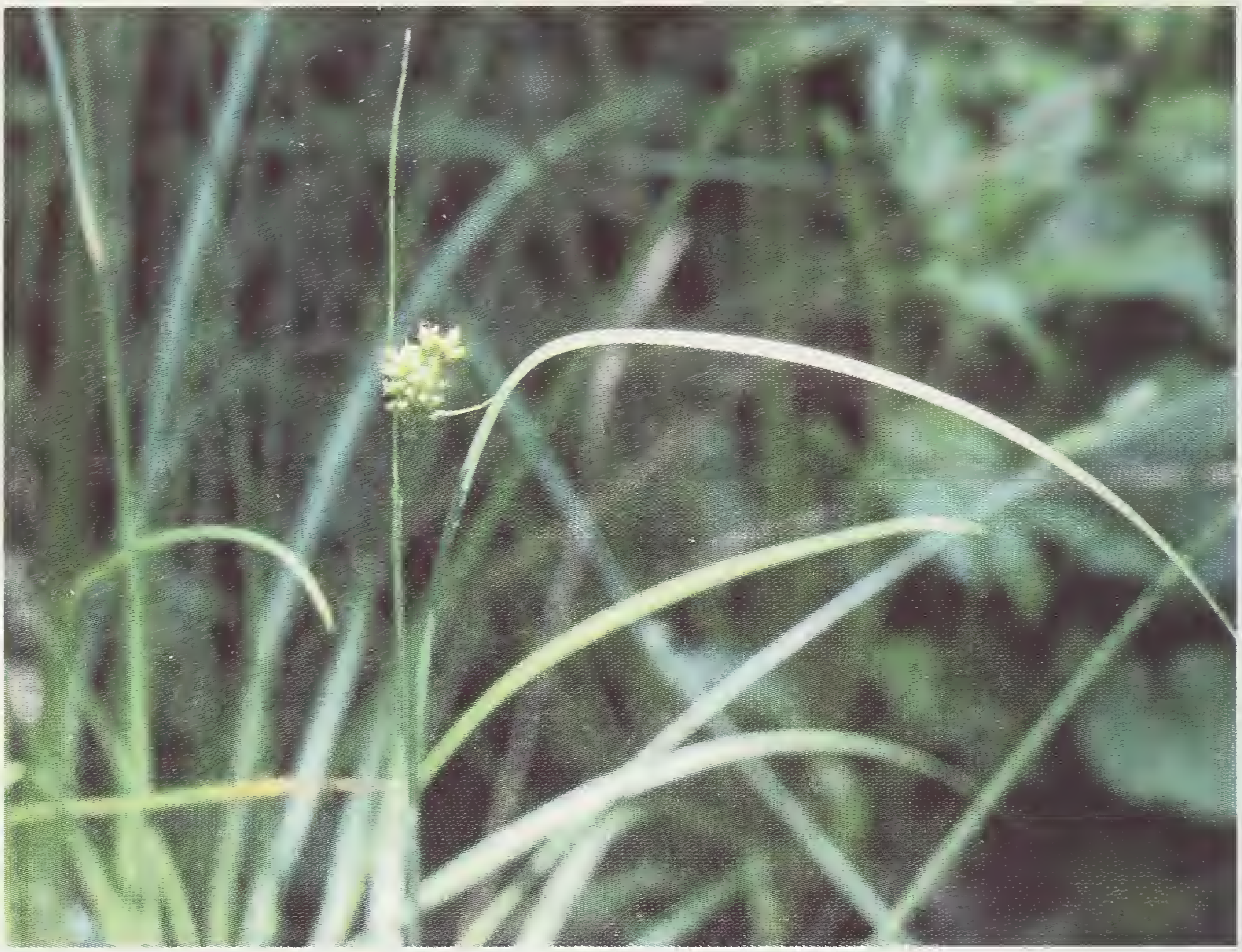


FIGURE 7. Pale sedge *Carex pallescens.*

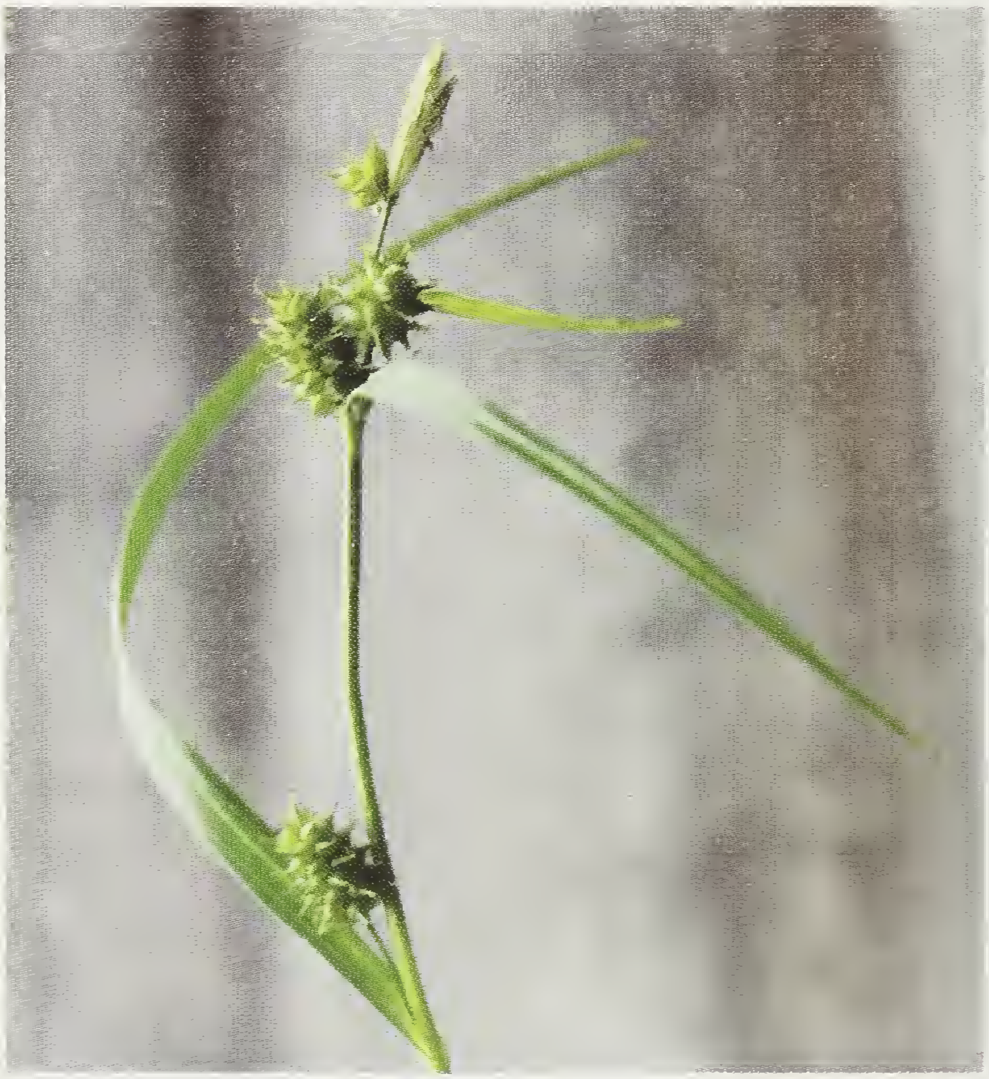


FIGURE 8. Common yellow-sedge *Carex demissa.*

stream in the Coldfall Wood coppice in 2007. It declined rapidly thereafter and was last seen in 2009. Although this diminutive species did not appear in the current Queen's Wood coppice, it was recorded briefly in 1993 in the small experimental coppice referred to above. It had gone by 1994. Rackham (2003) reports its similarly brief appearance in a coppice in the Bradfield Woods. He wrote: 'I had never seen it in a wood before, and seldom since. It lasted for a year and then disappeared'. This plant was also known to Petiver (1695) 'about Highgate and Hampstead' in the late seventeenth century. Other locally declining native species, which are known to persist in the seed bank, included blinks *Montia fontana*, three-nerved sandwort *Moehringia trinervia* and ragged robin *Silene flos-cuculi* (Figure 9), which were all seen in the Queen's Wood coppice, though there is some doubt about the provenance of the latter, which was planted in quantity in 2011 around the 'wildlife' pond lying just to the west of the coppice, and may have been deliberately planted into the coppice from there. In Coldfall Wood only, a single plant of vervain *Verbena officinalis*, which is known to survive in the seed bank, appeared in the coppice the year after it was cut but did not persist. This is another rare and decreasing plant in north London (Kent 2000). Also confined to the coppice in Coldfall Wood were scattered populations of yellow pimpernel *Lysimachia nemorum* (Figure 10) which appeared in 2008 and have persisted. This is another seed-bank species of damp woods and an ancient woodland indicator (Rose 1999). It has a long association with the wood, being recorded here before 1910, but was recently thought to have become extinct (Kent 1975).

Both woods are surrounded by houses with extensive gardens, so it is not surprising that a wide range of garden escapes were found in the two coppices. Tutsan has already been mentioned as an attractive native escaping from gardens into both coppices, but in Queen's Wood only, a single vigorous plant of water avens *Geum rivale* (Figure 11) also appeared in 2010 and has persisted. This too is sometimes grown in gardens and occasionally escapes. It has now almost disappeared from south-east England as a wild native plant. Forms of the native wood forget-me-not *Myosotis sylvatica* are widely grown in gardens, and often escape. They were widespread in both coppices. Shining crane's-bill *Geranium lucidum*, scarce as a native in Middlesex, sometimes occurs in gardens and it also escaped into both coppices in small quantity. Nettle-leaved bellflower *Campanula trachelium*, another scarce native in the vice-county and an ancient woodland indicator, is occasionally grown in gardens and was seen in the Coldfall Wood coppice in 2009 and 2011. Many non-native garden plants have also appeared. Himalayan honeysuckle *Leycesteria formosa* (Figure 12), an ornamental shrub bearing purple berries in the late summer, was present in large numbers as bird-sown seedlings in the Coldfall Wood coppice in its first year. Several of these have persisted and it is also present in smaller quantity in the Queen's Wood coppice. Yellow-flowered strawberry *Potentilla indica* (Figure 13), a popular garden plant sometimes recommended for 'ground cover', covers the ground most effectively in parts of both coppices. The cultivated 'Himalayan Giant' blackberry *Rubus armeniacus* became well established in the third year after both coppices were cut and now dominates large areas. A few plants of the less vigorous cut-leaved bramble *R. laciniatus* were also found. In addition, the following escaped garden ornamentals were found in both coppices: common Michaelmas daisy *Aster* × *salignus*, pampas-grass *Cortaderia selloana*, Argentine vervain *Verbena bonariensis*, purple toadflax *Linaria purpurea*, green alkanet *Pentaglottis sempervirens*, feverfew *Tanacetum parthenium*, hybrid Spanish bluebell *Hyacinthoides* × *massartiana*, early crocus *Crocus tommasinianus* and the ubiquitous butterfly-bush *Buddleja davidii*. A single seedling fuchsia *Fuchsia magellanica*, seldom recorded from the wild in London, was found in the Queen's Wood coppice in 2009, but did not persist. In the same coppice that year, pale galingale *Cyperus longus* was found near the old dog pond. This plant

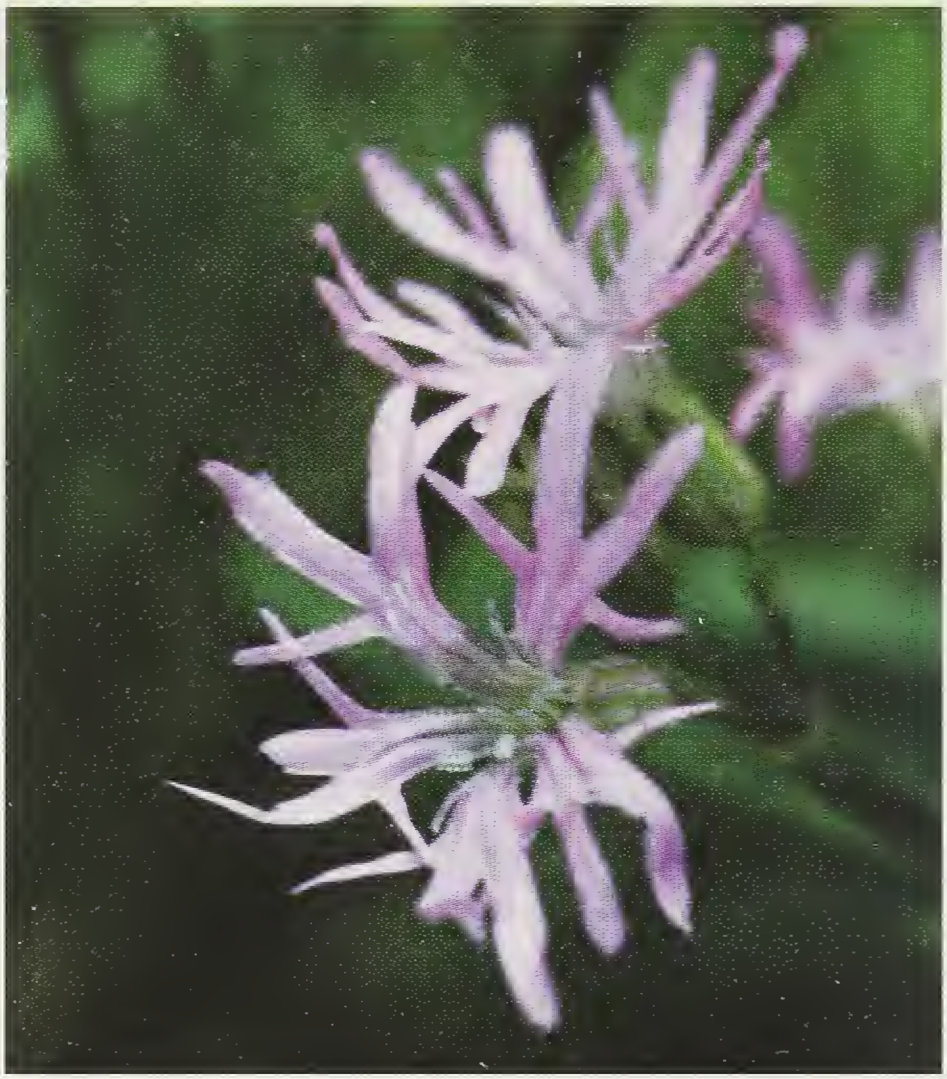


FIGURE 9. Ragged-robin *Silene flos-cuculi*.

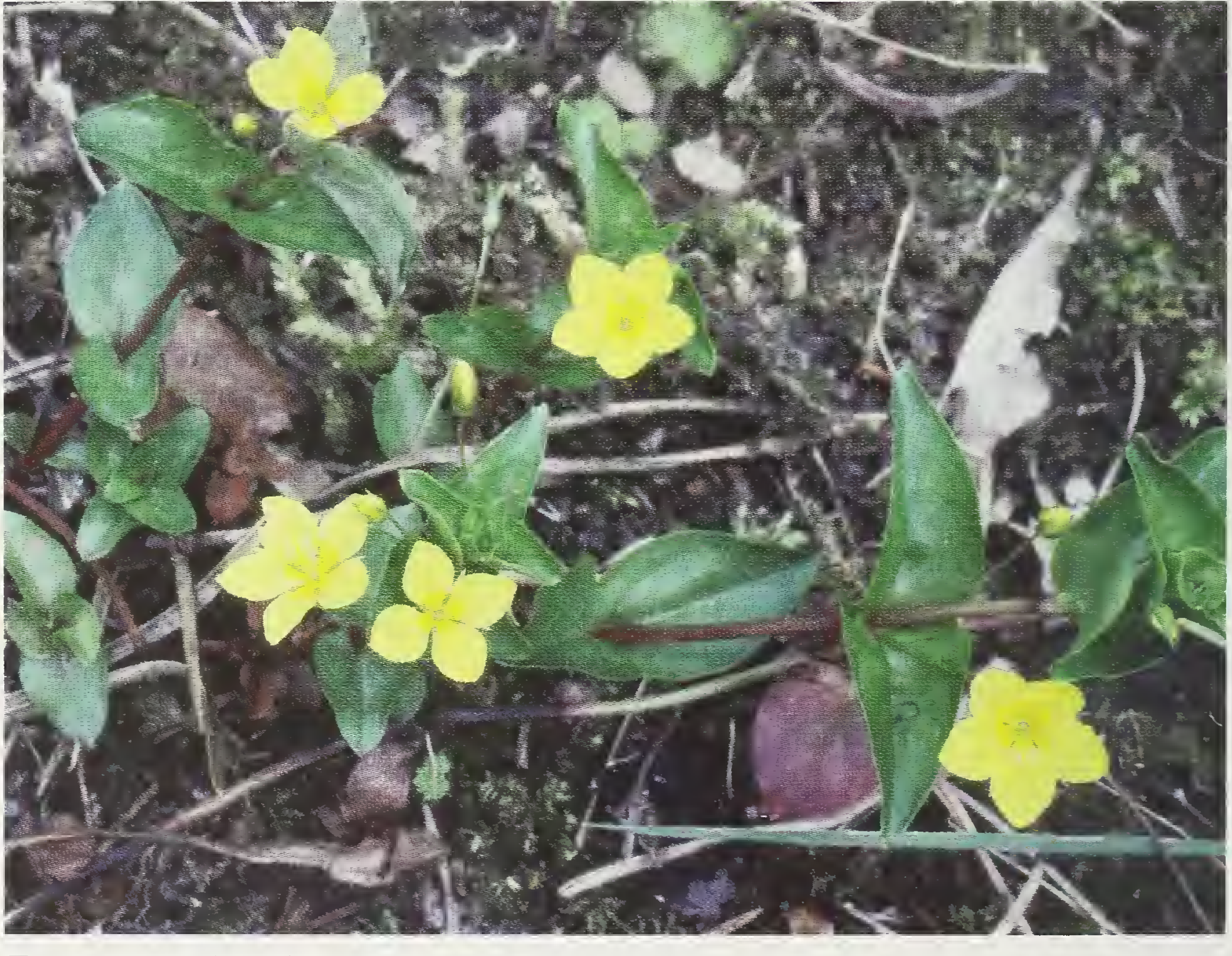


FIGURE 10. Yellow pimpernel *Lysimachia nemorum*.

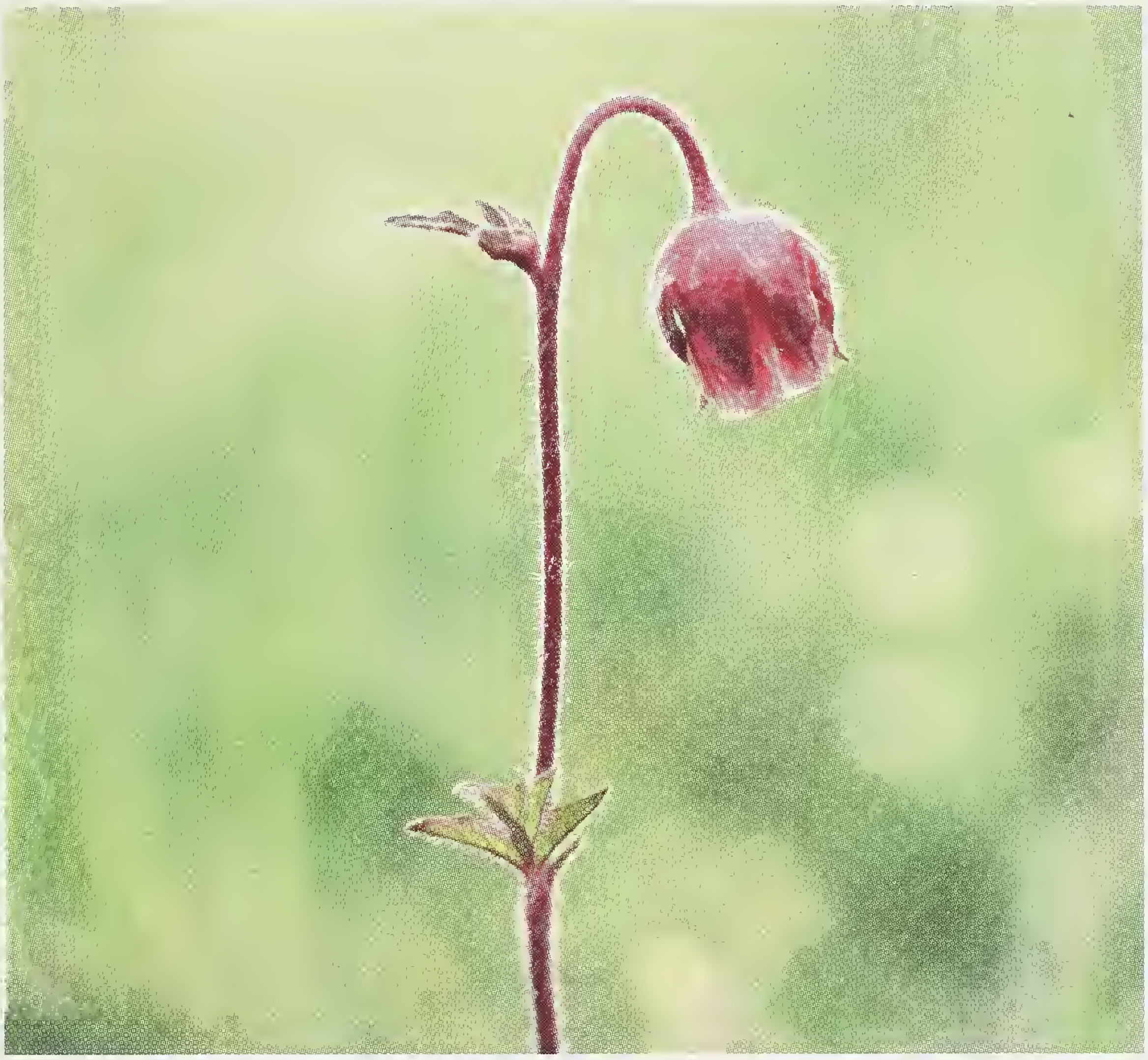


FIGURE 11. Water avens *Geum rivale*.

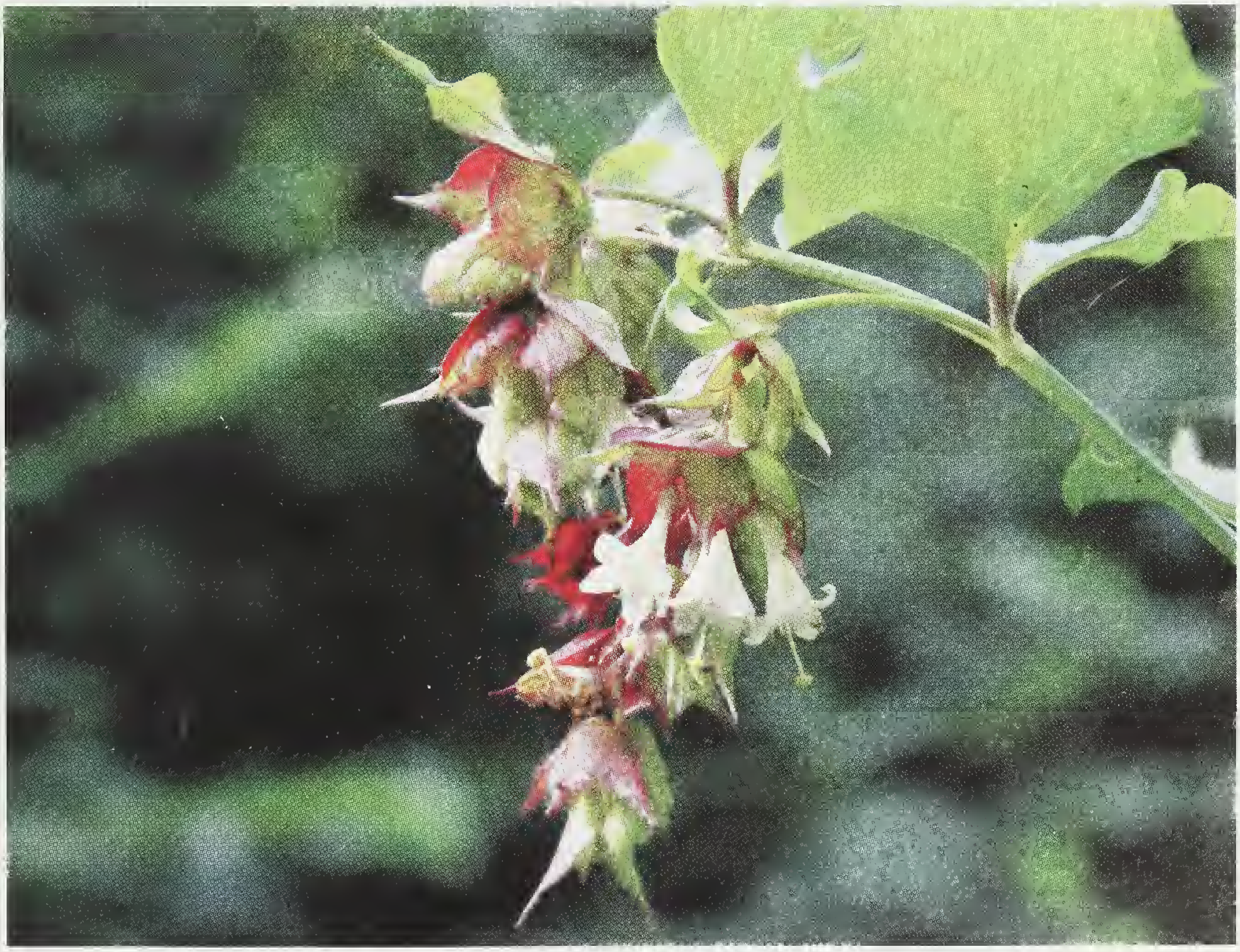


FIGURE 12. Himalayan honeysuckle *Leycesteria formosa*.

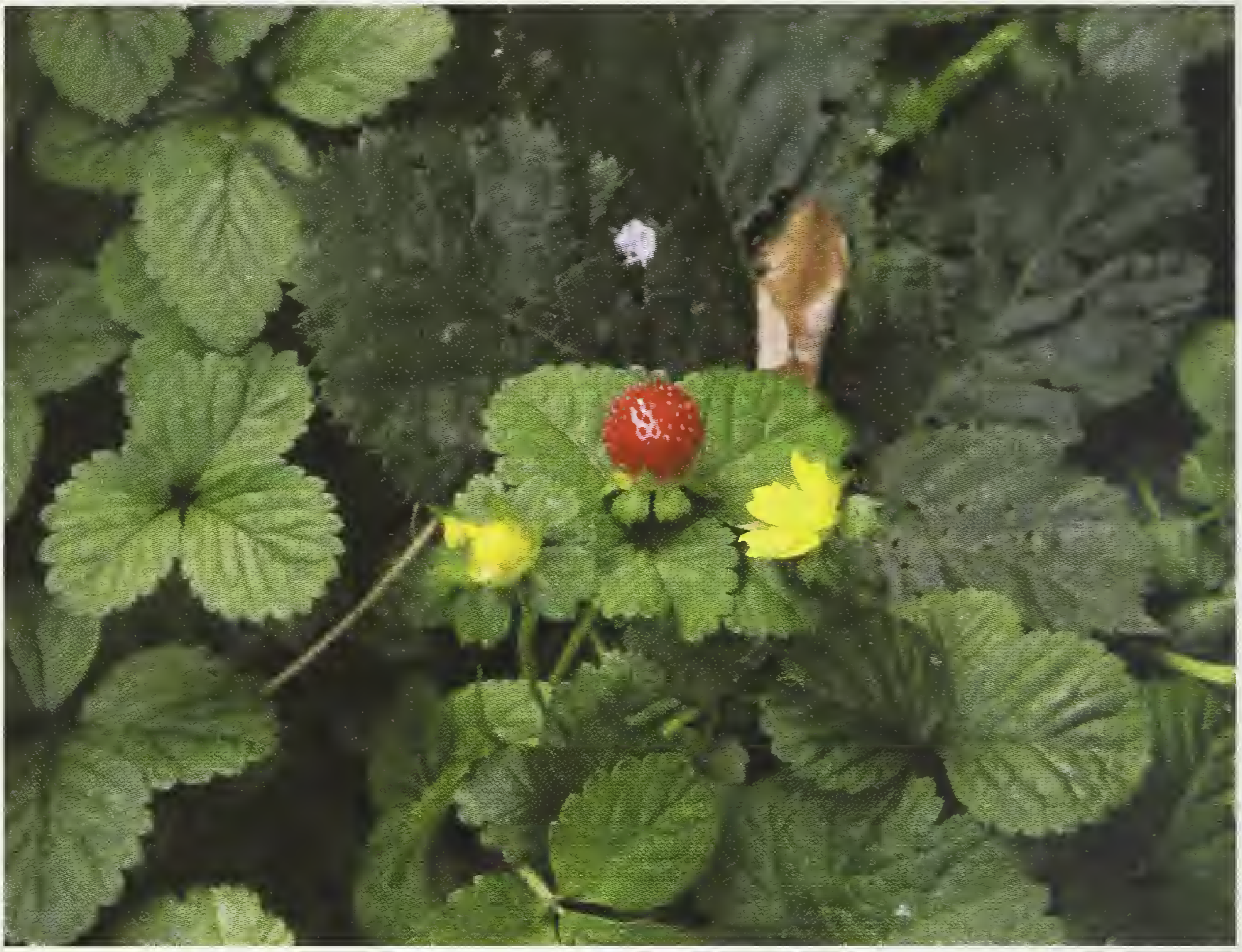


FIGURE 13. Yellow-flowered strawberry *Potentilla indica.*

can be invasive in other parts of London (Mark Spencer, pers. comm.), but it did not survive here. Indian balsam *Impatiens glandulifera,* another plant with a fearsome reputation for invasion, first appeared in the Coldfall Wood coppice in 2008 and, despite best efforts to control it, has persisted in low numbers. A single bird-sown firethorn *Pyracantha coccinea* has survived in the same coppice. In addition to these escaped garden plants, other exotics are likely to have arrived through the scattering of birdseed. These included ragweed *Ambrosia artemisiifolia,* and the grasses common millet *Panicum miliaceum,* yellow bristle-grass *Setaria pumila* and canary-grass *Phalaris canariensis,* which were all found in the Queen's Wood coppice in the first year after cutting, and cockspur *Echinochloa crus-galli,* which appeared in both coppices. None of these have persisted. Another non-native grass, water bent *Polypogon viridis,* which has recently become well established in the London area (Spencer 2009), appeared in both coppices and has spread. It is now particularly well established along the banks of the stream in Coldfall Wood.

Discussion

The coppices have dramatically increased the botanical diversity of the two woods. In Queen's Wood, three years after the coppice was cut, 150 new species had been added to the original sparse flora and eighty-six of these were new additions to the 225 seen in the entire wood during the 2007 survey. In Coldfall Wood, five years after the coppice was cut, 182 new species had been added to the original flora. Of these, no less than 121 were additions to the meagre 1985/86 survey total of 128 species from the wood as a whole. Many new arrivals were ephemeral plants that have not persisted, but others have germinated from buried seed (see Tables) and form a permanent part of the flora. Several of the latter are London rarities making a welcome return to the woods after many years' apparent absence. The two coppices have much in common and support similar floras. Seventy-two per cent of the species found in the Queen's Wood coppice were also found in the coppice in Coldfall Wood. However, there are significant differences. The Coldfall Wood coppice, including the 'everglade marsh', is about twice the size. The wider range of wetland plants found there reflects the presence of the stream and its associated damp habitats. A similar stream once flowed through the Queen's Wood coppice until it was culverted at the start of the twentieth century. C. S. Nicholson, then chairman of the LNHS Botany Committee (Northern district), saw marsh willowherb *Epilobium palustre* in Queen's Wood at this time (Kent and Lousley 1953: 124). He also recorded bog stitchwort *Stellaria alsine* (Kent and Lousley 1951: 37), brooklime *Veronica beccabunga* (Kent 1975) and pale sedge *Carex pallescens* (Kent and Lousley 1956: 297). The last three records were all reported from 'Highgate Woods', a broad-brush description which was used at that time to refer to Queen's Wood and Highgate Wood collectively. Brooklime and pale sedge have both been found in the Coldfall Wood coppice by the stream, and it seems likely that they would once have been present by the old stream in Queen's Wood. Thin-spiked wood-sedge *Carex strigosa* was found by Mark Spencer in 2002 about 150 metres to the west of the coppice, close to the course of the original stream (now marked by a drainage ditch). It might be difficult to de-culvert the stream in Queen's Wood (because of the possible flood risk to adjacent houses), but some more limited impeding of the drainage would bring great advantages to the flora of this coppice.

Historically, Coldfall Wood was coppiced much more recently (*c.*1935) than Queen's Wood and this may explain the presence in the former of a number of species absent from the latter. Seed-bank plants cannot survive indefinitely as viable seed. At least 130 years have elapsed since the Queen's Wood coppice was last cut, so seed of plants like yellow pimpernel *Lysimachia nemorum*, vervain *Verbena officinalis,* and the rare sedges found only in Coldfall Wood, may not have survived. Foxglove and slender St John's-wort, found in both coppices, produce exceptionally long-lived seed banks as indicated by Buckley (1992).

In both coppices the number of new species found each year declined rapidly after the great diversity seen in the first year (see Tables). However, the overall diversity of species has been maintained for longer in Coldfall Wood, where there was little change over five years. In the Queen's Wood coppice this diversity has fallen off more rapidly. Paradoxically, the heavier visitor pressure in the Coldfall Wood coppice may explain this difference. The stream has become a very attractive feature and many associated 'desire-line' paths have been created and kept open. This has held back the closing over of the canopy and kept the coppice more open than that in Queen's Wood which, with its surrounding impenetrable dead hedge, has been less heavily used and fewer paths have been made. The vegetation has grown up without disturbance and has more rapidly shaded out less-vigorous species.

Regrowth from the cut hornbeam stools varied between the two coppices. In Coldfall Wood, more than ninety per cent of the felled trees regenerated successfully and regrowth has been rapid. By contrast, in Queen's Wood hornbeam regeneration has been much slower. This may be due to the widely differing ages of the hornbeam in the two coppices, with the far older trees in Queen's Wood breaking less readily. In Coldfall Wood, regrowth after five years has reached a maximum of around seven metres. In Queen's Wood, after three years it has grown to less than three metres. Hornbeam seedlings were frequent in both coppices, growing to a maximum height of around two metres in Coldfall Wood and to about one metre in Queen's Wood. Other tree and shrub species have regenerated with varying degrees of success. Silver birch and mountain ash have both grown well. Disappointingly, very few oak seedlings have survived in either coppice. By 2011, there were just eight in Coldfall Wood and a similar number in Queen's Wood. Several of them were already infected with oak-mildew fungus *Microsphaera alphitoides*. Their progress will be monitored, but the long-term survival of most of them seems doubtful. Elsewhere in Queen's Wood, there is little significant oak regeneration apart from in one small area in the southern quarter (known as 'King's Wood' locally), where a dense stand of sapling sessile oaks have reached a height of about four metres beneath a mature parent tree. Two young guelder roses *Viburnum opulus* were recorded in the Coldfall Wood coppice in 2010. An ancient woodland indicator (Rose 1999), it is another decreasing species in Middlesex, thinly scattered elsewhere in the wood. John Benbow saw it there more than a hundred years ago (Kent 1975). Two widely separate wild service-tree saplings appeared near the northern boundary of the Queen's Wood coppice and may have originated as long-distance suckers from mature trees growing close by. No wild service-tree seedlings were seen in the current coppices, although, following a Coldfall Wood fall cut in 1994, more than a hundred were recorded in 1996. None of them survived for more than a year. Goat willow *Salix caprea*, absent before the two coppices were cut, has now become dominant in the wetter areas of both. Some trees have reached a height of almost eight metres in the marshy hollow at the southern end of the Coldfall Wood coppice and they have grown to about four metres near the dog-pond in Queen's Wood. In these areas, goat willow is now replacing hornbeam and could be coppiced back with advantage. A single hazel seedling was found in the Queen's Wood coppice in 2009 and has persisted. None has yet been seen in the Coldfall Wood coppice, although mature trees grow beside the stream in the north. Four aspen *Populus tremula* saplings were seen in the Queen's Wood coppice in 2011. This attractive native tree had not been recorded from the wood before, although it is widespread in damp woods in eastern England and elsewhere. Seedlings are very vulnerable to drought and, for successful establishment, require several weeks of unbroken wetness from May onwards (Rackham 2003). Recent wet summers seem to have provided ideal conditions. Sycamore *Acer pseudoplatanus* has been very sparse in Coldfall Wood, and has not yet been recorded from the Queen's Wood coppice. Its close relative the Norway maple *Acer platanoides* is plentiful along the southern boundary of Coldfall Wood, where it forms a component of the 'urban ecotone' between the edge of the wood and its urban surroundings (Gilbert and Bevan 1997). This boundary is close to the southern end of the coppice, but Norway maple has not encroached very far into the wood. A single sapling silver maple *Acer saccharinum* is well established on a bank of the stream. It is likely to have originated from wind-dispersed seed from a planted street tree. Such self-sown seedlings are becoming more frequent in the London area (Stace 2010) and I have seen many around Bounds Green, though they are seldom allowed to grow to any size.

Approximately twenty per cent of the plants found in both coppices were of non-native origin. They reflect the urban nature of the woods. As with the native flora, many early arrivals were ruderal species, like Canadian fleabane *Conyza canadensis*, and American willowherb *Epilobium ciliatum*, which occurred in both coppices. Oxford ragwort *Senecio squalidus* and narrow-leaved ragwort *S. inaequidens* (now spreading widely in London) appeared in the Queen's Wood coppice only. The seeds of these plants are wind-dispersed, and took advantage of the recently disturbed ground and high light levels. They are unlikely to persist. Other exotics are shade-tolerant and more likely to survive. In the 1992 experimental coppice in Queen's Wood, for example, Himalayan honeysuckle, bird-sown from a local garden, was first recorded in 1993 and was still present there fourteen years later in 2007. At that time, this coppice supported thirty-one species — almost double the sixteen recorded back in 1992 before the coppice was cut. Himalayan honeysuckle is now widespread in both the current coppices and, together with Himalayan giant blackberry, cut-leaved blackberry, firethorn and cotoneaster species, is likely to persist. How should this proliferation of exotic introductions be regarded? It is one of the great themes of urban ecology (Gilbert and Bevan 1997); these old woods are adapting to their new surroundings in a most natural way, by selecting from the incoming propagules those species most suited to the prevailing conditions. The woods should not be managed as imitation countryside and sanitized by the removal of all exotics. Nevertheless, a few may need to be controlled in the future. They include Himalayan honeysuckle, Indian balsam and yellow-flowered strawberry. At present, however, the rapid spread of native goat willow in both coppices is of more concern. Further monitoring will provide information about the distribution of all these plants and allow informed decisions to be made about their management. I hope that this paper will encourage further coppicing in both woods. The two projects have demonstrated that much of the historic coppice flora can be restored despite the long lapse of time. Rackham's experience in Hayley Wood in Cambridgeshire showed that even after an eighty-year gap it is possible to recover much of the coppice flora (Rackham 2003). In Coldfall Wood, the length of time between coppices has been similar and in Queen's Wood it has been considerably longer. It is encouraging to report that in the winter of 2009/2010, the original 1990 coppice was cut again. This rotation of around twenty years should be adequate to maintain most of the ground vegetation. With the assistance of volunteers from both Friends groups, we will continue to monitor botanical change in these beautiful woods for many years to come.

Acknowledgements

I should like to thank Lucy Roots, Alison Watson and Sarah Graham-Brown from the Friends of Queen's Wood for much invaluable assistance and financial support with monitoring the coppice flora in Queen's Wood. The Friends oversaw a successful bid to the SITA Trust for funding to carry out the coppice work. They were also supported through Haringey Council's 'Making the Difference' grant. Trainee volunteers from the Friends have contributed much time, energy and enthusiasm in helping to monitor changes to the coppice flora. Their continued involvement will be crucial in carrying forward the monitoring into the future. In Coldfall Wood, Julia Cassells and the Friends of Coldfall Wood provided strong support for the project from the outset. The BTCV, with guidance from John Roots and Michael Bury, ensured that 'desire-line' paths were kept open in the Coldfall Wood coppice. Kate Lloyd-Bostock from Trees for Cities gave valuable assistance with the HLF bid, which, in partnership with Haringey Council, paid for the coppicing in Coldfall Wood. Dr Mark Spencer identified a number of the more obscure exotic plants, including Kiwi fruit and tall nightshade *Solanum chenopodioides*. Ian Holt, my successor as Haringey Council's Project Officer (Nature Conservation), has been supportive throughout and has overseen all the work carried out in the two coppices. Finally, I should like to thank Dr David Corcoran for technical assistance with the photographs and with drawing up the two tables and the map.

References

BEVAN, D. 1986. *Woodland contrasts: an investigation into aspects of the ecology of two north London woods: Coppetts Wood and Coldfall Wood.* Unpublished dissertation, University of London.

BEVAN, D. 1992. The natural history of Haringey's ancient woodlands. *Lond. Nat.* 71: 9–20.

BEVAN, D. 2010. *The flora of Queen's Wood.* http://www.freespace.virgin.net/conserving.bevan

BUCKLEY, G. P. (ed.). 1992. *Ecology and management of coppice woodlands.* Chapman and Hall.

GAME, M. 2000. *Queen's Wood Management Brief.* Prepared for LB Haringey. London Ecology Unit/Greater London Authority.

GILBERT, O. and BEVAN, D. 1997. The effect of urbanisation on ancient woodlands. *Br. Wildlife* **8**: 213–218.

GRAHAM-BROWN, S. 2006. Ancient woodland indicator species and ecological change in two London woodlands. *Lond. Nat.* **85**: 51–75.

GRIME, J. P, HODGSON, J. G. and HUNT, R. 2007. *Comparative plant ecology. A functional approach to common British species.* Ed. 2. Castlepoint Press.

KENT, D. H. 1975. *The historical flora of Middlesex.* The Ray Society, London.

KENT, D. H. 2000. *Flora of Middlesex. A supplement to The historical flora of Middlesex.* The Ray Society, London.

KENT, D. H. and LOUSLEY, J. E. 1951–1957. A hand list of the plants of the London Area. *Lond. Nat.* **30–36** (Suppls), 368 pp.

PETIVER, J. 1695. *More rare plants growing wild in Middlesex, communicated by Mr James Petiver, in Edmund Gibson's translation of Camden's Britannia, etc. London.* NB. I have been unable to consult the original documents, but have relied on a transcription of two lectures given by Frederick Prickett on the 17th and 31st March 1846, to the Highgate Literary and Scientific Institution, in which he lists the plants 'communicated by Petiver' in the above document and their local distribution. This transcription is held in the HLSI archives.

RACKHAM, O. 2003. *Ancient woodland; its history, vegetation and uses in England.* New edition. Castlepoint Press.

ROSE, F. 1999. Indicators of ancient woodland. The use of vascular plants in evaluating ancient woods for nature conservation. *Br. Wildlife* **10**: 241–251.

SILVERTOWN, J. 1978. The history of woodlands in Hornsey. *Lond. Nat.* **57**: 11–25.

SPENCER, M. 2009. Whither London's flora? *Lond. Nat.* **88**: 75–83.

STACE, C. 2010. *New flora of the British Isles.* Ed. 3. Cambridge University Press.

TABLE 1. Presence/absence of vascular plants and ferns in Coldfall Wood Coppice.

Taxon #	**Vernacular #**	**Seed bank***	**Before coppice 2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Acer platanoides	Norway maple		×	×	×	×	×	×
Acer pseudoplatanus	Sycamore		×	×	×	×	×	×
Acer saccharinum	Silver maple				×	×	×	×
Actinidia chinensis var. *deliciosa*	Chinese gooseberry			×				
Aesculus hippocastanum	Horse-chestnut		×	×	×	×	×	×
Agrostis capillaris	Common bent	Sb				×	×	×
Agrostis stolonifera	Creeping bent	Sb		×	×	×	×	×
Alchemilla mollis	Garden lady's-mantle			×				
Alliaria petiolata	Garlic mustard			×	×	×		×
Allium ursinum	Ramsons				×	×	×	×
Alopecurus geniculatus	Marsh foxtail	Sb			×			
Anemone nemorosa	Wood anemone		×	×	×	×	×	×
Angelica sylvestris	Wild angelica				×	×	×	×
Anisantha sterilis	Barren brome				×			×
Anthriscus sylvestris	Cow parsley		×	×				×
Antirrhinum majus	Snapdragon	Sb			×	×		
Aquilegia vulgaris	Columbine					×	×	×
Arabidopsis thaliana	Thale cress	Sb		×			×	
Arctium minus	Lesser burdock	Sb				×	×	×
Arrhenatherum elatius	False oat-grass				×	×		×
Artemisia vulgaris	Mugwort	Sb			×	×		
Aster novi-belgii	Confused Michaelmas daisy				×	×	×	×

Table 1. Continued.

Taxon #	**Vernacular #**	**Seed bank***	**Before coppice 2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Aster × *salignus*	Common Michaelmas daisy		×	×	×	×	×	×
Athyrium filix-femina	Lady-fern				×	×	×	×
Atriplex patula	Common orache	Sb		×				
Atriplex prostrata	Spear-leaved orache	Sb		×				×
Avena sativa	Oat			×				
Bellis perennis	Daisy				×	×	×	×
Betula pendula	Silver birch		×	×	×	×	×	×
Betula pubescens	Downy birch				×	×	×	×
Borago officinalis	Borage			×				
Brassica napus subsp. *oleifera*	Oil-seed rape				×			
Bromopsis ramosa	Hairy-brome				×			
Bromus hordeaceus	Soft-brome				×		×	
Buddleja davidii	Butterfly-bush	Sb		×	×	×	×	×
Caltha palustris	Marsh-marigold			P	×	×	×	×
Campanula poscharskyana	Trailing bellflower		×	×	×	×	×	×
Campanula trachelium	Nettle-leaved bellflower	Sb				×		×
Capsella bursa-pastoris	Shepherd's-purse	Sb		×				×
Cardamine flexuosa	Wavy bitter-cress	Sb	×	×	×	×	×	×
Cardamine hirsuta	Hairy bitter-cress	Sb					×	
Carex acutiformis	Lesser pond-sedge			P	×	×	×	×
Carex demissa	Common yellow-sedge	?Sb				×	×	×
Carex leporina	Oval sedge	Sb			×	×	×	×
Carex pallescens	Pale sedge	Sb		×	×	×	×	×
Carex pendula	Pendulous sedge	?Sb	×	×	×	×	×	×
Carex pilulifera	Pill sedge	Sb			×			
Carex remota	Remote sedge	Sb	×	×	×	×	×	×
Carex sylvatica	Wood-sedge	Sb	×	×	×	×	×	×
Carpinus betulus	Hornbeam		×	×	×	×	×	×
Centranthus ruber	Red valerian			×	×	×	×	×
Cerastium fontanum	Common mouse-ear			×	×		×	×
Cerastium glomeratum	Sticky mouse-ear	Sb		×	×	×	×	×
Chamerion angustifolium	Rosebay willowherb			×	×	×	×	×
Chenopodium album	Fat-hen	Sb		×				
Chenopodium polyspermum	Many-seeded goosefoot	Sb		×				
Circaea lutetiana	Enchanter's-nightshade			×	×	×	×	×
Cirsium arvense	Creeping thistle	Sb		×	×	×	×	×
Cirsium vulgare	Spear thistle	Sb		×	×	×	×	×
Cochlearia danica	Danish scurvygrass	?Sb		×				
Conyza canadensis	Canadian fleabane	Sb		×				

TABLE 1. Continued.

Taxon #	**Vernacular #**	**Seed bank***	**Before coppice 2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Conyza sumatrensis	Guernsey fleabane			×	×	×	×	×
Coronopus didymus	Lesser swine-cress	Sb		×				
Cortaderia selloana	Pampas-grass					×	×	
Corylus avellana	Hazel		×	×	×	×	×	×
Cotoneaster horizontalis	Wall cotoneaster						×	×
Cotoneaster sp.	a cotoneaster			×	×			
Crataegus monogyna	Hawthorn		×	×	×	×	×	×
Crataegus × media	Hybrid hawthorn *C. monogyna × C. laevigata*		×	×	×	×	×	×
Crepis capillaris	Smooth hawk's-beard	?Sb		×				
Crepis vesicaria	Beaked hawk's-beard				×			
Crocus tommasinianus	Early crocus		×	×				
Cymbalaria muralis	Ivy-leaved toadflax	?Sb			×			
Dactylis glomerata	Cock's-foot			×	×	×	×	×
Deschampsia cespitosa	Tufted hair-grass	Sb		×	×	×	×	×
Digitalis purpurea	Foxglove	Sb		×	×	×		
Dryopteris dilatata	Broad buckler-fern	?Sb	×	×	×	×	×	×
Dryopteris filix-mas	Male-fern	?Sb	×	×	×	×	×	×
Echinochloa crus-galli	Cockspur			×				
Elytrigia repens	Common couch				×			
Epilobium ciliatum	American willowherb	Sb		×	×	×	×	×
Epilobium hirsutum	Great willowherb	Sb		×	×	×	×	×
Epilobium montanum	Broad-leaved willowherb	Sb	×	×	×	×	×	×
Epilobium obscurum	Short-fruited willowherb	Sb		×	×	×	×	×
Epilobium parviflorum	Hoary willowherb	Sb		×	×	×		×
Epilobium roseum	Pale willowherb	Sb		×	×	×		×
Epilobium tetragonum	Square-stalked willowherb	Sb				×		
Epilobium × heterocaule	Hybrid willowherb *E. montanum × E. roseum*	Sb						×
Epilobium × interjectum	Hybrid willowherb *E. montanum × ciliatum*	Sb				×		
Epilobium × vicinum	Hybrid willowherb *E. obscurum × ciliatum*	Sb				×		
Erophila verna	Common whitlowgrass	Sb			×			
Euphorbia peplus	Petty spurge	Sb		×	×	×		
Fallopia convolvulus	Black-bindweed	Sb		×				
Festuca rubra	Red fescue				×	×	×	
Fragaria vesca	Wild strawberry	Sb		×	×	×	×	×
Fraxinus excelsior	Ash			×	×	×		×
Galium aparine	Cleavers		×	×	×	×	×	×
Geranium dissectum	Cut-leaved crane's-bill	?Sb				×		
Geranium lucidum	Shining crane's-bill	?Sb					×	×

TABLE 1. Continued.

Taxon #	Vernacular #	Seed bank*	Before coppice 2006	2007	2008	2009	2010	2011
Geranium robertianum	Herb-robert	?Sb	×	×	×	×	×	×
Geranium × *oxonianum*	Druce's crane's-bill						×	×
Geum urbanum	Wood avens		×	×	×	×	×	×
Glyceria fluitans	Floating sweet-grass	Sb						×
Hedera helix	Common ivy		×	×	×	×	×	×
Helminthotheca echioides	Bristly oxtongue			×	×	×	×	
Heracleum sphondylium	Hogweed						×	
Holcus lanatus	Yorkshire-fog	Sb		×	×	×	×	×
Holcus mollis	Creeping soft-grass		×	×	×	×	×	×
Hordeum murinum	Wall barley					×		
Hyacinthoides × *massartiana*	Hybrid bluebell *H. non-scripta* × *hispanica*		×	×	×	×	×	×
Hypericum androsaemum	Tutsan	?Sb	×	×	×	×	×	×
Hypericum pulchrum	Slender St John's-wort	Sb		×	×	×	×	×
Hypericum tetrapterum	Square-stalked St John's-wort	Sb			×	×	×	×
Hypochaeris radicata	Cat's-ear							×
Ilex aquifolium	Holly		×	×	×	×	×	×
Impatiens glandulifera	Indian balsam				×	×	×	×
Iris pseudacorus	Yellow iris			P	×	×	×	×
Isolepis setacea	Bristle club-rush	Sb		×	×	×		
Juncus articulatus	Jointed rush	Sb		×	×	×	×	
Juncus bufonius	Toad rush	Sb		×	×	×		
Juncus conglomeratus	Compact rush	Sb	×	×	×	×	×	×
Juncus effusus	Soft-rush	Sb	×	×	×	×	×	×
Juncus tenuis	Slender rush	Sb		×	×			
Lactuca serriola	Prickly lettuce	?Sb		×				
Lamiastrum galeobdolon subsp. *montanum*	Yellow archangel			×				
Lapsana communis	Nipplewort	Sb		×	×	×		
Lathyrus pratensis	Meadow vetchling	?Sb					×	
Leucanthemum × *superbum*	Shasta daisy	?Sb			×			
Leycesteria formosa	Himalayan honeysuckle			×	×	×	×	×
Linaria purpurea	Purple toadflax	Sb				×	×	×
Lobelia erinus	Garden lobelia			×				
Lolium perenne	Perennial rye-grass			×	×	×	×	×
Lonicera periclymenum	Honeysuckle		×	×	×	×	×	×
Lotus corniculatus	Common bird's-foot-trefoil	Sb				×		
Lotus pedunculatus	Greater bird's-foot-trefoil	Sb			×	×	×	×
Luzula pilosa	Hairy wood-rush	Sb	×	×	×	×	×	
Lycopus europaeus	Gypsywort				×		×	×

TABLE 1. Continued.

Taxon #	Vernacular #	Seed bank*	Before coppice 2006	2007	2008	2009	2010	2011
Lysimachia nemorum	Yellow pimpernel	Sb			×	×	×	×
Malus sylvestris	Crab apple		×	×	×	×	×	×
Matricaria discoidea	Pineappleweed	Sb			×			×
Matricaria recutita	Scented mayweed	Sb		×				
Medicago lupulina	Black medick	Sb		×				
Melica uniflora	Wood melick			×	×	×	×	
Melissa officinalis	Balm		×	×	×	×	×	×
Mentha aquatica	Water mint			P	×	×	×	×
Mycelis muralis	Wall lettuce					×		
Myosotis sylvatica	Wood forget-me-not	?Sb		×	×	×	×	×
Narcissus agg.	Cultivated daffodil		×	×	×	×	×	×
Oxalis debilis	Large-flowered pink-sorrel			×	×			
Oxalis exilis	Least yellow-sorrel	Sb		×				
Papaver rhoeas	Common poppy	Sb			×			
Pentaglottis sempervirens	Green alkanet			×	×	×	×	×
Persicaria lapathifolia	Pale persicaria	Sb	×	×	×	×	×	×
Persicaria maculosa	Redshank	Sb		×	×	×	×	×
Phalaris arundinacea	Reed canary-grass			P	×	×	×	×
Phragmites australis	Common reed			P	×	×	×	×
Phyllitis scolopendrium	Hart's-tongue		×	×	×	×	×	×
Plantago major	Greater plantain	Sb	×	×	×	×	×	×
Poa annua	Annual meadow-grass	Sb		×	×	×	×	×
Poa pratensis	Smooth meadow-grass	Sb			×			×
Poa trivialis	Rough meadow-grass	Sb			×	×	×	×
Polygonum arenastrum	Equal-leaved knotgrass	Sb		×				
Polygonum aviculare	Knotgrass	Sb		×	×	×	×	×
Polypogon viridis	Water bent			×	×	×	×	×
Polystichum setiferum	Soft shield-fern		×	×	×	×	×	×
Potentilla indica	Yellow-flowered strawberry			×	×	×	×	×
Primula vulgaris	Primrose	Sb	×	×	×	×	×	×
Prunella vulgaris	Selfheal	Sb		×	×	×	×	×
Prunus avium	Wild cherry		×	×	×	×	×	×
Prunus laurocerasus	Cherry laurel			×				
Pseudofumaria lutea	Yellow corydalis		×	×				
Pteridium aquilinum	Bracken	?Sb	×	×	×	×	×	×
Pyracantha coccinea	Firethorn				×	×	×	×
Quercus robur	Pedunculate oak		×	×	×	×	×	×
Ranunculus acris	Meadow buttercup				×	×	×	×
Ranunculus ficaria	Lesser celandine		×	×			×	×
Ranunculus flammula	Lesser spearwort	Sb		×	×	×	×	×

TABLE 1. Continued.

Taxon #	**Vernacular #**	**Seed bank***	**Before coppice 2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Ranunculus repens	Creeping buttercup	Sb		×	×	×	×	×
Ribes rubrum	Red currant					×		
Rorippa nasturtium-aquaticum	Water-cress			P	×	×	×	×
Rosa canina agg.	Dog-rose					×		×
Rubus armeniacus	cv. Himalayan Giant blackberry					×	×	×
Rubus fruticosus agg.	Bramble	Sb	×	×	×	×	×	×
Rubus idaeus	Raspberry	Sb	×	×	×	×	×	×
Rubus laciniatus	Cut-leaved blackberry			×	×	×		×
Rumex conglomeratus	Clustered dock	?Sb				×	×	
Rumex crispus	Curled dock	Sb			×			
Rumex obtusifolius	Broad-leaved dock	Sb		×	×	×	×	×
Rumex sanguineus	Wood dock	Sb	×	×	×	×	×	×
Sagina apetala subsp. *apetala*	Annual pearlwort	Sb		×				
Sagina procumbens	Procumbent pearlwort	Sb		×			×	×
Salix caprea	Goat willow			×	×	×	×	×
Salix cinerea subsp. *oleifolia*	Grey willow				×	×	×	×
Salix × *reichardtii*	Hybrid willow *S. caprea* × *S. cinerea*					×	×	×
Salix × *rubens*	Hybrid crack-willow *S. alba* × *S. fragilis*					×	×	×
Sambucus nigra	Elder	?Sb	×	×		×	×	×
Schedonorus giganteus	Giant fescue		×	×	×	×	×	×
Scorzoneroides autumnalis	Autumn hawkbit							×
Scrophularia nodosa	Common figwort	Sb	×	×	×	×	×	×
Senecio erucifolius	Hoary ragwort				×	×		×
Senecio jacobaea	Common ragwort	Sb		×	×	×	×	×
Senecio vulgaris	Groundsel	Sb		×	×	×		×
Sisymbrium officinale	Hedge mustard	Sb		×				×
Solanum dulcamara	Bittersweet	?Sb	×	×	×	×	×	×
Solanum lycopersicum	Tomato			×				
Solanum nigrum	Black nightshade	Sb		×				
Sonchus asper	Prickly sow-thistle	Sb		×		×		×
Sonchus oleraceus	Smooth sow-thistle	Sb		×		×		
Sorbaria sp.	Sorbaria				×	×	×	×
Sorbus aucuparia	Rowan		×	×	×	×	×	×
Stachys sylvatica	Hedge woundwort	Sb	×	×	×	×	×	×
Stellaria media	Common chickweed	Sb		×	×	×	×	×
Tanacetum parthenium	Feverfew			×				
Taraxacum agg.	Dandelion		×	×	×	×	×	×
Taxus baccata	Yew		×	×	×	×	×	×

TABLE 1. Continued.

Taxon #	Vernacular #	Seed bank*	Before coppice 2006	2007	2008	2009	2010	2011
Tellima grandiflora	Fringecups	?Sb	×	×	×	×	×	×
Tragopogon porrifolius	Salsify					×		
Trifolium dubium	Lesser trefoil	Sb		×	×	×	×	
Trifolium hybridum	Alsike clover	Sb		×				
Trifolium repens	White clover	Sb		×	×	×	×	×
Tripleurospermum inodorum	Scentless mayweed	Sb		×				
Triticum aestivum	Bread wheat				×			
Typha angustifolia	Lesser bulrush			P	×	×	×	×
Urtica dioica	Common nettle	Sb	×	×	×	×	×	×
Verbascum thapsus	Great mullein	Sb			×			
Verbena bonariensis	Argentinian vervain			×				
Verbena officinalis	Vervain	Sb		×				
Veronica arvensis	Wall speedwell	Sb		×	×	×		×
Veronica beccabunga	Brooklime	Sb				×	×	×
Veronica hederifolia subsp. *lucorum*	Ivy-leaved speedwell	Sb		×			×	×
Veronica officinalis	Heath speedwell	Sb			×	×	×	×
Veronica persica	Common field-speedwell	Sb		×				
Veronica serpyllifolia	Thyme-leaved speedwell	Sb		×	×	×	×	×
Viburnum opulus	Guelder-rose						×	×
Vicia hirsuta	Hairy tare	Sb			×			
Vicia tetrasperma	Smooth tare	Sb			×			
Viola reichenbachiana	Early dog-violet						×	×
Viola riviniana	Common dog-violet		×	×	×	×	×	×
Viola × wittrockiana	Garden pansy			×				
Vulpia myuros	Rat's-tail fescue	Sb			×	×		×
Zantedeschia aethiopica	Altar-lily			P	×	×		
		127 = 53%						
			2006	2007	2008	2009	2010	2011
Overall total species in coppice: **241**	Total species in coppice **in each year:**		59	163	163	164	148	159
Additional species: 182	Total **new** species in each year:			107	42	22	8	3

* Species having, or probably having, persistent seed banks (Grime et al. 2007).

# Stace (2010).

P = Planted in reed bed.

TABLE 2. Presence/absence of vascular plants and ferns in Queen's Wood Coppice.

Taxon #	**Vernacular #**	**Seed bank***	**Before coppice 2008**	**2009**	**2010**	**2011**
Achillea millefolium	Yarrow			×		
Agrostis capillaris	Common bent	Sb	×	×	×	×
Agrostis gigantea	Black bent	Sb			×	
Agrostis stolonifera	Creeping bent	Sb			×	
Alliaria petiolata	Garlic mustard			×		
Alopecurus geniculatus	Marsh foxtail	Sb			×	×
Alopecurus pratensis	Meadow foxtail				×	
Ambrosia artemisiifolia	Ragweed			×		
Anemone nemorosa	Wood anemone		×	×	×	×
Anisantha sterilis	Barren brome				×	×
Anthriscus sylvestris	Cow parsley			×		×
Antirrhinum majus	Snapdragon			×		
Arctium minus	Lesser burdock	Sb		×	×	×
Arrhenatherum elatius	False oat-grass			×	×	×
Artemisia vulgaris	Mugwort	Sb			×	×
Aster × *salignus*	Common Michaelmas daisy			×	×	×
Atriplex prostrata	Spear-leaved orache	Sb		×	×	×
Betula pendula	Silver birch			×	×	×
Betula pubescens	Downy birch					×
Brachypodium sylvaticum	False brome				×	
Bryonia dioica	White bryony			×		
Buddleja davidii	Butterfly-bush	Sb		×	×	×
Calamagrostis epigejos	Wood small-reed					×
Calystegia silvatica	Large bindweed	?Sb		×		
Capsella bursa-pastoris	Shepherd's-purse	Sb		×	×	
Cardamine flexuosa	Wavy bitter-cress	Sb		×	×	×
Cardamine hirsuta	Hairy bitter-cress	Sb				×
Carex flacca	Glaucous sedge	Sb			×	
Carex pendula	Pendulous sedge	?Sb		×	×	×
Carex remota	Remote sedge	Sb	×	×	×	×
Carex sylvatica	Wood-sedge	Sb	×	×	×	×
Carpinus betulus	Hornbeam		×	×	×	×
Cerastium fontanum	Common mouse-ear	Sb				×
Cerastium glomeratum	Sticky mouse-ear	Sb			×	
Chamerion angustifolium	Rosebay willowherb			×	×	×
Chenopodium album	Fat-hen	Sb		×		
Chenopodium polyspermum	Many-seeded goosefoot	Sb		×		
Circaea lutetiana	Enchanter's-nightshade		×	×	×	×
Cirsium arvense	Creeping thistle	Sb		×	×	×
Cirsium vulgare	Spear thistle	Sb	×	×	×	×

TABLE 2. Continued.

Taxon #	**Vernacular #**	**Seed bank***	**Before coppice 2008**	2009	2010	2011
Conyza canadensis	Canadian fleabane	Sb		×		
Conyza sumatrensis	Guernsey fleabane		×	×	×	×
Cortaderia selloana	Pampas-grass			×		
Corylus avellana	Hazel			×	×	×
Crataegus laevigata	Midland hawthorn		×	×	×	×
Crataegus × *media*	Hybrid hawthorn *C. monogyna* × *C. laevigata*		×	×	×	×
Crepis capillaris	Smooth hawk's-beard	?Sb		×	×	×
Crepis vesicaria	Beaked hawk's-beard				×	
Crocus tommasinianus	Early crocus			×	×	×
Cyperus eragrostis	Pale galingale			×		
Dactylis glomerata	Cock's-foot		×	×	×	×
Deschampsia cespitosa	Tufted hair-grass	Sb				×
Digitalis purpurea	Foxglove	Sb			×	
Echinochloa crus-galli	Cockspur			×		
Epilobium ciliatum	American willowherb	Sb		×	×	×
Epilobium hirsutum	Great willowherb	Sb	×	×	×	×
Epilobium montanum	Broad-leaved willowherb	Sb	×	×	×	×
Epilobium obscurum	Short-fruited willowherb	Sb		×	×	×
Epilobium parviflorum	Hoary willowherb	Sb		×	×	×
Epilobium roseum	Pale willowherb	Sb		×		
Epilobium tetragonum	Square-stalked willowherb	Sb		×	×	×
Epipactis helleborine	Broad-leaved helleborine	?	×	×	×	×
Euphorbia peplus	Petty spurge	Sb		×		
Fagus sylvatica	Beech				×	
Fallopia convolvulus	Black-bindweed	Sb		×		
Festuca rubra	Red fescue			×		×
Fragaria vesca	Wild strawberry	Sb		×	×	×
Fraxinus excelsior	Ash		×	×	×	×
Fuchsia magellanica	Fuchsia			×		
Galium aparine	Cleavers		×	×	×	×
Geranium dissectum	Cut-leaved crane's-bill	?Sb		×	×	×
Geranium lucidum	Shining crane's-bill	?Sb				×
Geranium pyrenaicum	Hedgerow crane's-bill	?Sb		×	×	
Geranium robertianum	Herb-robert	?Sb		×	×	×
Geum rivale	Water avens				×	×
Geum urbanum	Wood avens		×	×	×	×
Gnaphalium uliginosum	Marsh cudweed	Sb		×		
Hedera helix	Common ivy		×	×	×	×
Helminthotheca echioides	Bristly oxtongue			×	×	×

TABLE 2. Continued.

Taxon #	**Vernacular #**	**Seed bank***	**Before coppice 2008**	**2009**	**2010**	**2011**
Hieracium agg.	Hawkweed agg.					×
Holcus lanatus	Yorkshire-fog	Sb		×	×	×
Holcus mollis	Creeping soft-grass		×	×		
Hordeum murinum	Wall barley				×	×
Humulus lupulus	Hop				×	
Hyacinthoides × *massartiana*	Hybrid bluebell		×	×	×	×
Hypericum androsaemum	Tutsan	?Sb	×	×	×	×
Hypericum pulchrum	Slender St John's-wort	Sb		×	×	×
Hypericum tetrapterum	Square-stalked St John's-wort	Sb		×	×	×
Hypochaeris radicata	Cat's-ear			×	×	×
Ilex aquifolium	Holly		×	×	×	×
Ilex × *altaclerensis*	Highclere holly *I. aquifolium* × *I. perado*		×	×	×	×
Juncus bufonius	Toad rush	Sb		×		
Juncus conglomeratus	Compact rush	Sb			×	×
Juncus effusus	Soft-rush	Sb		×	×	×
Juncus tenuis	Slender rush	Sb				×
Lactuca serriola	Prickly lettuce			×	×	×
Lactuca virosa	Great lettuce	Sb		×		×
Lapsana communis	Nipplewort	Sb		×	×	×
Leucanthemum vulgare	Ox-eye daisy	Sb				×
Leycesteria formosa	Himalayan honeysuckle			×	×	×
Linaria purpurea	Purple toadflax	Sb		×		×
Linaria vulgaris	Common toadflax	Sb		×	×	
Lolium perenne	Perennial rye-grass			×	×	×
Melilotus albus	White melilot	Sb			×	
Moehringia trinervia	Three-nerved sandwort	?Sb		×		
Montia fontana	Blinks	?Sb			×	
Mycelis muralis	Wall lettuce			×	×	×
Myosotis sylvatica	Wood forget-me-not	?Sb		×	×	×
Nigella damascena	Love-in-a-mist			×		
Oenothera glazioviana	Large-flowered evening-primrose	Sb			×	
Panicum miliaceum	Common millet			×		
Pentaglottis sempervirens	Green alkanet				×	×
Persicaria lapathifolia	Pale persicaria	Sb		×		
Persicaria maculosa	Redshank	Sb		×	×	
Phalaris canariensis	Canary-grass			×		
Phleum pratense	Timothy	?Sb		×	×	
Physalis peruviana	Cape-gooseberry			×		
Picris hieracioides	Hawkweed oxtongue	?Sb				×

TABLE 2. Continued.

Taxon #	**Vernacular #**	**Seed bank***	**Before coppice 2008**	2009	2010	2011
Plantago major	Greater plantain	Sb	×	×	×	×
Poa annua	Annual meadow-grass	Sb	×	×	×	×
Poa trivialis	Rough meadow-grass	Sb	×	×	×	×
Polygonum arenastrum	Equal-leaved knotgrass	Sb			×	
Polygonum aviculare	Knotgrass	Sb	×	×	×	×
Polypogon viridis	Water bent			×		
Populus tremula	Aspen					×
Potentilla indica	Yellow-flowered strawberry			×	×	×
Prunus avium	Wild cherry		×	×		×
Pseudofumaria lutea	Yellow corydalis			×	×	
Quercus petraea	Sessile oak		×	×	×	×
Quercus robur	Pedunculate oak		×	×	×	×
Ranunculus acris	Meadow buttercup		×			
Ranunculus bulbosus	Bulbous buttercup	Sb			×	×
Ranunculus ficaria	Lesser celandine					×
Ranunculus repens	Creeping buttercup	Sb		×	×	×
Ribes nigrum	Black currant			×		
Rosa canina agg.	Dog-rose				×	
Rubus armeniacus	cv. Himalayan Giant blackberry					×
Rubus fruticosus agg.	Bramble	Sb	×	×	×	×
Rubus idaeus	Raspberry	Sb		×	×	×
Rubus laciniatus	Cut-leaved bramble			×		×
Rumex crispus	Curled dock	Sb		×		
Rumex obtusifolius	Broad-leaved dock	Sb		×	×	×
Rumex sanguineus	Wood dock	Sb	×	×	×	×
Sagina procumbens	Procumbent pearlwort	Sb		×	×	×
Salix caprea	Goat willow			×	×	×
Salix cinerea subsp. *oleifolia*	Grey willow				×	×
Salix × *reichardtii*	Hybrid willow *S. caprea* × *S. cinerea*					×
Sambucus nigra	Elder	?Sb	×	×	×	×
Schedonorus giganteus	Giant fescue		×	×	×	×
Scorzoneroides autumnalis	Autumn hawkbit			×		
Scrophularia nodosa	Common figwort	Sb		×	×	×
Senecio erucifolius	Hoary ragwort				×	×
Senecio inaequidens	Narrow-leaved ragwort			×		×
Senecio jacobaea	Common ragwort	Sb			×	×
Senecio squalidus	Oxford ragwort	?Sb		×		
Senecio sylvaticus	Heath groundsel	Sb		×	×	×
Senecio viscosus	Sticky groundsel	Sb		×		×

TABLE 2. Continued.

Taxon #	**Vernacular #**	**Seed bank***	**Before coppice 2008**	**2009**	**2010**	**2011**
Senecio vulgaris	Groundsel	Sb		×	×	×
Setaria pumila	Yellow bristle-grass			×		
Silene flos-cuculi	Ragged-robin	Sb				×
Sinapis arvensis	Charlock	Sb		×		
Sisymbrium officinale	Hedge mustard	Sb		×		
Solanum chenopodioides	Green nightshade			×		
Solanum dulcamara	Bittersweet	?Sb		×	×	×
Solanum lycopersicum	Tomato			×	×	
Solanum nigrum	Black nightshade	Sb		×		
Sonchus arvensis	Perennial sow-thistle	Sb		×		×
Sonchus asper	Prickly sow-thistle	Sb	×	×	×	×
Sonchus oleraceus	Smooth sow-thistle	Sb		×	×	×
Sorbaria sorbifolia	Sorbaria				×	
Sorbus aucuparia	Rowan			×	×	×
Sorbus torminalis	Wild service-tree				×	×
Stachys sylvatica	Hedge woundwort	Sb			×	×
Stellaria media	Common chickweed	Sb	×	×	×	×
Symphytum × *uplandicum*	Russian comfrey				×	×
Tanacetum parthenium	Feverfew				×	
Taraxacum agg.	Dandelion		×	×	×	×
Taxus baccata	Yew			×		
Triticum aestivum	Bread wheat			×	×	
Tussilago farfara	Colt's-foot			×	×	×
Urtica dioica	Common nettle	Sb	×	×	×	×
Verbascum thapsus	Great mullein	Sb		×	×	
Verbena bonariensis	Argentinian vervain			×		
Veronica officinalis	Heath speedwell	Sb			×	×
Veronica persica	Common field-speedwell	Sb			×	
Veronica serpyllifolia	Thyme-leaved speedwell	Sb		×		
Vicia hirsuta	Hairy tare	Sb		×	×	
Vicia sativa subsp. *segetalis*	Common vetch	Sb		×		
Viola riviniana subsp. *riviniana*	Common dog-violet			×		×
		100 = 53%				
			2008	**2009**	**2010**	**2011**
Overall total species in coppice: **189**	Total species in coppice **in each year:**		**39**	**140**	**124**	**118**
Additional species: **150**	Total **new** species in coppice in each year:			**103**	**32**	**15**

* Species having, or probably having, persistent seed banks (Grime et al. 2007).

# Stace (2010).

Book review

The tiger: soul of India. Valmik Thapar. Oxford University Press, New Delhi. 2011. xvi, 168 pp. Hardback, 3,295 rupees, £80, ISBN 978 0 19 806969 0.

This is Valmik Thapar's eighteenth book on tigers in thirty-five years. Beautifully produced, it is a survey of the tiger in the life, myth and art of India. It is an excellent text for A-level and foundation year art students looking for inspiration for a project. The author's own photographs of tigers at Ranthambore rub shoulders with clay seal impressions from Mohenjo Daro, elegant Mughal court art, Victorian book illustrations and devotional oleographs of the martial Goddess Durga, destroyer of demons, riding on her tiger. Folk art and tradition share pride of place with emperors and European nabobs.

All too many of the illustrations, particularly those relating to Europeans in India, show the tiger as the object of the hunt. Elegant Mughal princesses also seem to have had a penchant for shooting driven tigers, or at least to have been illustrated doing so. The balance is redressed slightly by the inclusion of Tipu Sultan's tiger: that startling automaton, now in the Victoria and Albert Museum, representing a tiger killing an Englishman, and fitted out with a harmonium to reproduce suitable sounds for the two participants. Stubbs' painting of the tiger sent from India by Lord Clive and housed at Blenheim ('Blenderim' in the book, which is a nice image in itself) gets a mention, but is not reproduced. William Blake's 'tyger, burning bright' is also referred to in passing. One reason for a tiger to burn, is that in artistic representation from body painting to weaving, the stripes are often stylized as flames, both magical and protective.

I have only two reservations about this book. There is no index, and although this is essentially an illustrated book, the text is worth referring to. The other reservation is related to the price. The cover price in rupees implies a price of around £45, but copies available in this country appear to cost nearly double.

David W. Allen

On the distribution, ecology and management of non-native reptiles and amphibians in the London Area.

Part 1. Distribution and predator/prey impacts

TOM E. S. LANGTON
Triton House, Bramfield, Halesworth, Suffolk IP19 9AE

WILL ATKINS
LEHART, c/o 5 Roughdown Villas Road, Hemel Hempstead, Hertfordshire HP3 0AX

CLIVE HERBERT
67a Ridgeway Avenue, East Barnet, Hertfordshire EN4 8TL

Abstract 83
Introduction 84
  Past interest and research 86
  History of recorded introductions 86
  Development of London's pet trade 88
Background 89
  Archaeological and taxonomic considerations 89
  Climatic and zoogeographic considerations 89
  Wildlife trade 90
Species accounts — reptiles 90
  European lizards and snakes 90
  Non-European lizards and snakes 95
  Tortoises 96
  Terrapins and freshwater turtles 97
  Basic freshwater terrapin and turtle indentification in the London Area 109
Species accounts — amphibians 116
  Water Frogs 116
  Other European amphibians 128
  Non-European amphibians 131
Exotic species imported accidentally 134
Non-native amphibian and reptile hotspots in and around the London Area 134
Problematic aspects of the chelonian pet trade 136
Ecological impacts and implications 138
  Nature conservation concerns 138
  Impacts of exotic herpetofauna in the wild 139
  Trends in London's wild terrapin numbers 141
Acknowledgements 142
References 144
Appendices 147

Abstract

This is a review of fifty-one non-native species, subspecies, intergrades or hybrids of amphibians and reptiles recorded as living wild in the London Area. Of these fifty-one taxa, referred to here as 'types', around twenty-one are amphibians of which fourteen have bred successfully and thirty are reptiles of which just two have been proven to breed. Other types may have bred unrecorded. A rapid increase in the number of types of terrapin in the wild has been observed since trade restrictions on red-eared terrapin importation in 1997. Many new species, mostly North American, but including those from Africa and Australia, can now be found in the wild. The traditional split of Water Frogs into two species and a hybrid has now diversified to include many more types that may interbreed when mixed. The distribution and spread of Water Frogs over the last two hundred years in this part of south-east England is described for the first time. Brief descriptions and identification notes are provided and zoogeographic and historical aspects of colonization are considered. Part 1 refers to distribution and aspects of impacts from the species' role in the food chain of the communities where they have colonized. The trade in herpetofauna and nature conservation and welfare issues are considered. Aspects of disease impacts and philosophical considerations are described in Part 2.

Introduction

There are at least fifty-one species, subspecies, intergrades or hybrids (referred to here as 'types') of amphibian and reptile recorded as living in the wild in the London Area. It includes those that are or have been self-maintaining through breeding for at least one generation (sixteen types). It also includes three types that are being recorded in the wild on a more frequent basis, that are tropical species often released in summer and are unlikely to survive a winter period. There are in addition to the fifty-one types, a larger number of species recorded once or twice that have escaped, often for a few days or weeks, to be recaught or to die outdoors, for which records have not been particularly sought as they are so numerous, although some examples are given. Of the fifty-one types, around twenty-one are amphibians, of which fourteen have bred successfully, and thirty are of reptiles of which just two have been proven to breed. At least four of the types (and possibly up to a further four suspected but not recorded) are native to the UK but have originated from mainland Europe.

The 'London Area' is the centre of abandonment of non-native herpetofauna in the United Kingdom. The London Area as described here includes the London Natural History Society recording area and a hinterland representing an edge-area outside of up to ten kilometres or so. In recent decades the number of such species seen has overtaken the twelve species that are considered unequivocally to be, native to the British Isles (not counting marine turtles) and the London Area in recent times (Langton 1991). We also refer to the smaller Greater London area that represents the more urban land, almost all of which falls inside the M25 motorway (Figure 1).

Of the fifty-one types of herpetofauna (shortened here to herp or herps), relatively few have become established or have spread to any degree, although some have been subject to removal activities. Removal has been either to prevent breeding and the potential of further spread and harm to other wild species (nature conservation), or potential damage to economic interest (e.g., fishery), or to reduce perceived harm to the animal in an unsuitable location for its well-being and survival (welfare).

Records have been received by the current recorder (TESL) from our Society's members since the mid 1980s. Until that period the number of records of introduced species reported in *The London Naturalist* from time to time has been relatively few, generally increasing through the twentieth century after about 1935 and with the greater increase in importation of animals from Continental Europe as pets in the 1950s. In addition to a recent appeal to members for records we have included those made available by the London, Essex and Hertfordshire Amphibian and Reptile Trust (LEHART) and those of the County Amphibian and Reptile Groups (ARGs), many of which to some extent gather records as a part of their established function to carry out conservation work. Several ARGs were established and coordinated with help from the Fauna and Flora Preservation Society (now Fauna and Flora International) in the 1980s and steadily built up via the Herpetofauna Groups of Britain and Ireland (HGBI) in the 1990s and early 2000s by the UK herpetofauna conservation charity Froglife. In addition, some of the county or area-based biological record centres were able to provide some records. A large volume of information was provided by Herpetofauna Consultants International (HCI Ltd) from its library and archives.

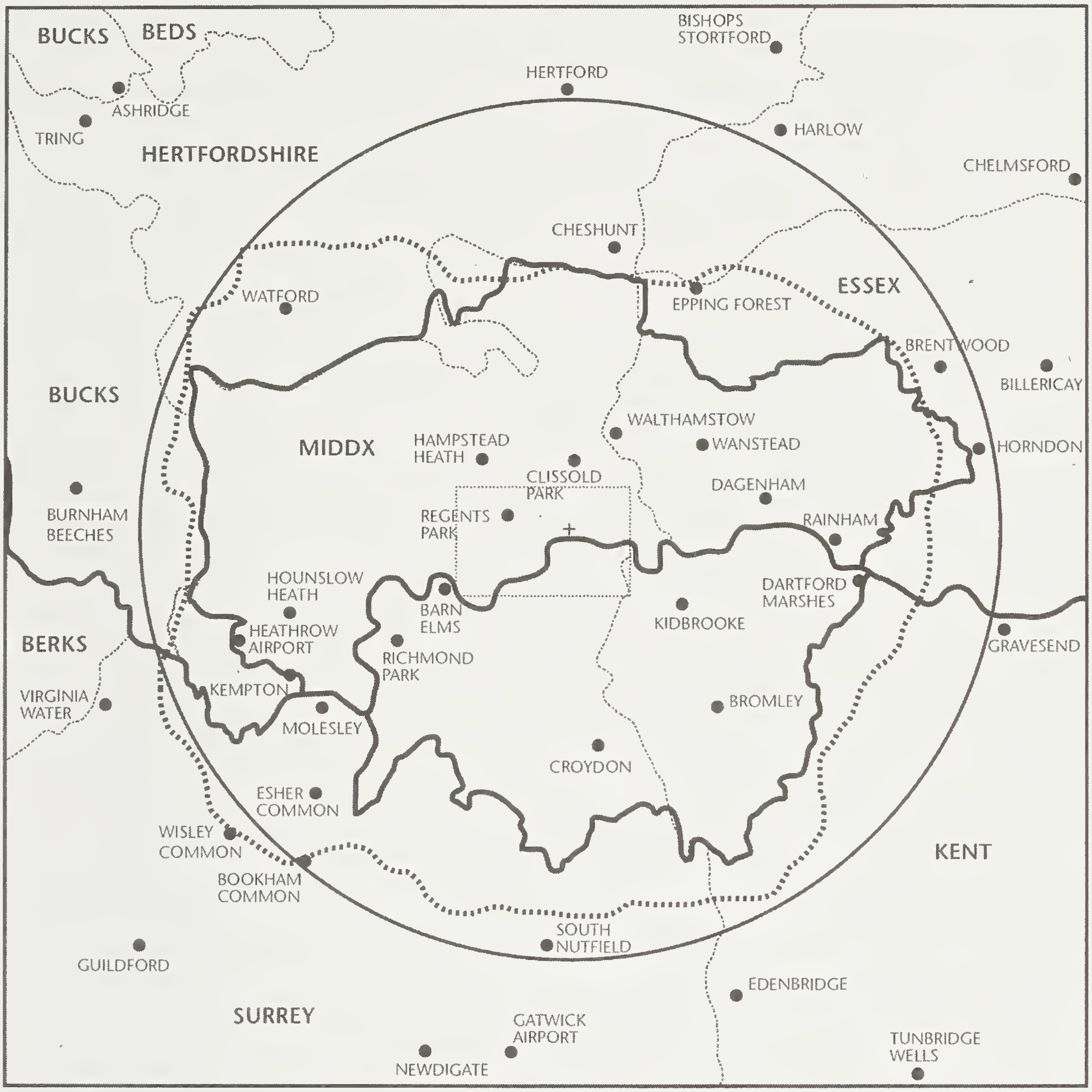


FIGURE 1. Study area 80 × 80 km showing the outer edge of Greater London boroughs (solid regular line), the London Natural History Society recording boundary (Solid circle), the M25 motorway (dashed line), with many of the locations that are cited within the text. The bold line running west to east is the River Thames.

Many published research papers, reports and university student studies were also consulted and searched for records. In total, around 1,200 records have been collated of which about 200 have been generated by our members and 620 by your LNHS recorder from various sources. Around eighty additional records have been provided by LEHART and 280 from six county record centres and from local ARG records. With the species accounts, the number of records inside and outside the LNHS area within the London Area are stated when the number of records exceed a total of around ten records.

With regard to taxonomic nomenclature, there has been substantial disruption to scientific naming in recent years which is unhelpful with respect to continuity of general reference for non-specialists, and with reference to published legal documents including international law. This is particularly the case when names change more than once over a short period, for example with alpine newt. Although some names are widely accepted, we have kept with previously familiar scientific names but also given new names that have become more generally accepted in recent years or partially accepted by taxonomic convention.

Past interest and research

In the past, Fitter (1949, 1959, 1960) and Yalden (1965, 1967) in particular made initial efforts to document non-native amphibian and reptile reports for the LNHS area, before but mostly between 1940 and the 1970. The first local atlas of distribution that included non-native herpetofauna covering at least a part of the LNHS recording area was for Essex (Plant 1983) and there have been more recent contributions, for Kent (Philp 1998), for Surrey (Wycherley and Anstis 2001) and for Hertfordshire (Clark 2001). Trevor Weeks conducted a survey of feral terrapins for his National Terrapin Survey in the mid 1990s (Weeks 1995, 1997) and a final checklist in 1999, covering the whole of the UK. This showed just how extensive the abandonment of terrapins was becoming. The report identified over 200 UK sightings of which around fifty (twenty-five per cent) were from the London Area, making London the densest area for terrapin abandonment in the UK.

With Water Frogs, Surrey ARG members, and particularly Julia Wycherley, can be singled out for contributing significantly by collating reports by local recorders from the south-central and south-west of the study area in Surrey. In Middlesex and elsewhere Doug Napier has carried out extensive fieldwork to recheck sites for continued Water Frog occupancy. Apart from this there have been only a few volunteer and university student studies nationally. This is possibly a reflection of a perception, that existed until fairly recently, that the release of amphibians and reptiles could not potentially impact significantly on agriculture or human health to any great extent, or cause harm to native wildlife and so it has not been a priority area. Other workers have studied individual sites and those persons are listed in the acknowledgements. It is not exactly clear how comprehensive our coverage has been; however it is likely that most individuals or populations persisting for any duration would have been noticed over the years, at least post 1900. However, those species not breeding or present only for a few years (such as populations centred on a single pond) may have been overlooked.

History of recorded introductions

The Changing Wild Life of Britain (Edlin 1952)appears to be the earliest review of non-native fauna in Britain and followed Malcolm Smith's (1951) New Naturalist series volume *The British Amphibians and Reptiles* that included non-natives. Previously, Cooke (1893) had summarized the stories, snippets and other evidence pertaining to Water Frogs from journals such as the *Zoologist* and other published texts. The first full attempt at documenting all introduced animal species in the British Isles was *The Ark in our midst* (Fitter 1959). This was extended by *The Naturalised Animals of the British Isles* (Lever 1977) that has been recently updated (Lever 2009) and with a world-wide review (Lever 2003). Frazer (1964) and the New Naturalist series subsequent updates have provided further information on non-natives but were not comprehensive reviews. In a European context, Langton and Burton (1997) listed over thirteen species of amphibians and reptiles introduced outside their range in Europe. The first extensive European herpetofauna distribution atlas was produced by the European Herpetological Society (Gasc et al. 1997) but in many countries national atlases now provide additional information. Other information collated for this study relates to the London Area (Figure 2) and south-east England in general. This includes:

- Reports published within *The London Naturalist* over the last hundred years or so
- A range of articles published in Victorian/nineteenth-century journals
- County reports for Essex, Kent, Surrey, Buckinghamshire and Hertfordshire
- A monograph on Water Frog dispersal in Kent (Philp 1998)

- Student dissertations on aspects of Water Frogs, terrapins and palaeo-archaeology
- Reports on activities of biological supply companies at Newdigate and South Nutfield in Surrey
- Technical reports prepared by a range of national charities, voluntary bodies and individuals
- Papers published in *British Wildlife* magazine
- Government-funded research reports
- Publications in scientific journals.

Historically, it is thought that fish breeding and fish transport in Asia began around 5,000 years ago in China and that more recently the Romans and others imported wild and domesticated animals to England, to establish them for human food and/or for in rituals/entertainment. It is almost impossible to think that children did not carry small animals as pets on such journeys during Iron and Bronze Age travel too. Whether they survived, or were released or escaped in sufficient numbers to colonize is not known. What is known from archaeological investigation so far is that all of the generally accepted UK native herpetofauna

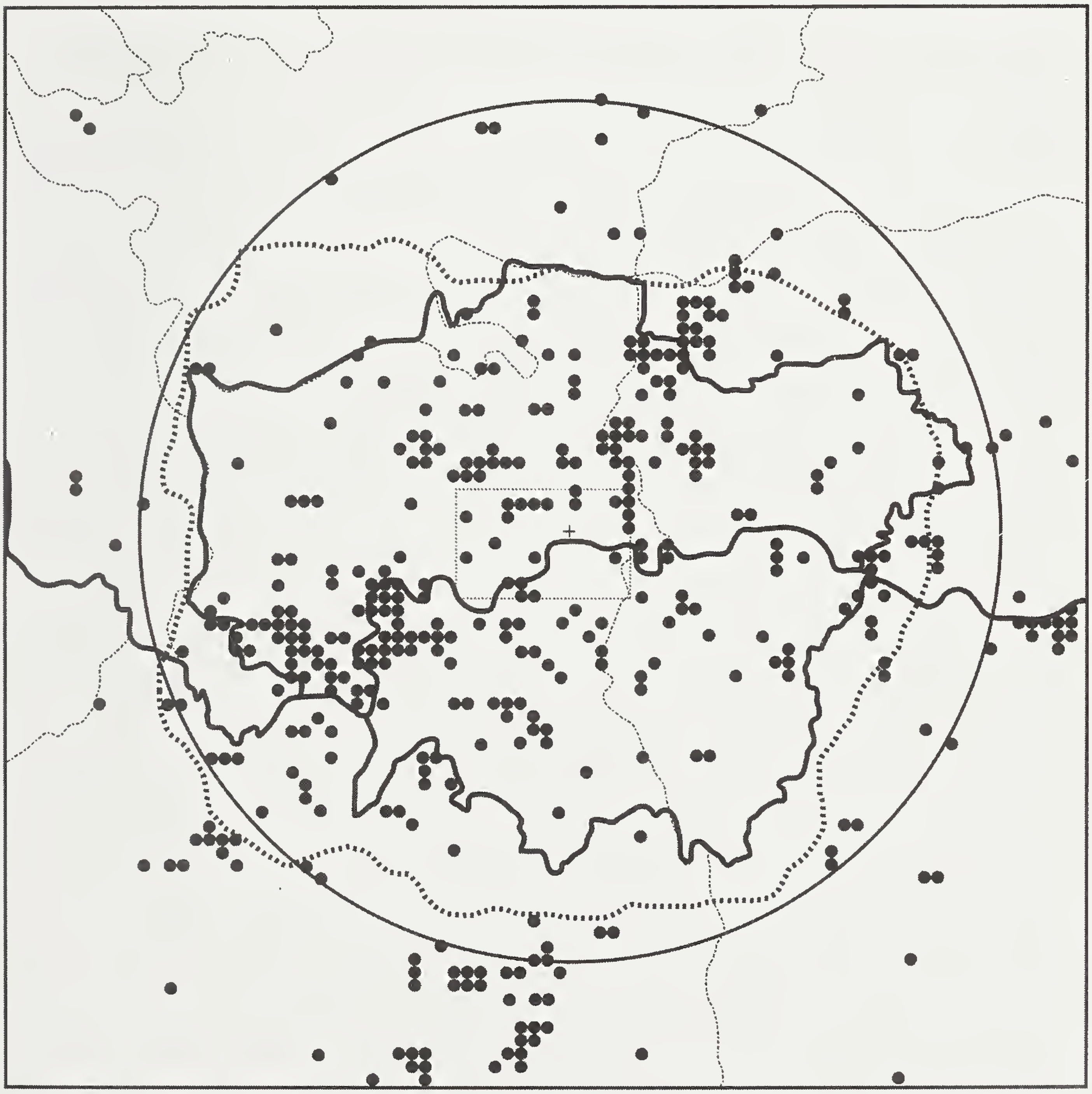


FIGURE 2. One-kilometre distribution records for all non-native reptile and amphibian records in the London Area over the period 1830 to 2011.

species in modern times are represented in the fossil/sub-fossil UK fauna after the last Ice Age, when they might be expected to have colonized naturally. They recolonized the land mass that is now Britain across areas that would then become eroded and flooded by sea level rise.

Development of London's pet trade

In the last century, although the human population of Greater London reduced from an estimated 8.6 to around 6.7 million between 1940 and the 1980s, there was growth on the outskirts of modern London with numerous new garden cities, new towns and other housing developments. At some point around the late 1950s, as British economic conditions improved, parents were more able to buy glass aquaria or 'tanks' or to have wood or plastic containers for children to keep pets at home than before, and garden pond building became more frequent. As access to wild areas in and around London to collect reptiles and amphibians was shrinking and books written for the American pet hobby market on home-keeping became available, demand for pet amphibians and reptiles in urban areas extended beyond the traditional sale of grass snake, sand lizard and slow-worm, to batches of animals sent from all over Europe to Britain in large quantities. Shops with extensive ranges such as the Harrods pet department and the (recently closed) Palmers Pet shop near Regent's Park offered a range of species collected in the wild. *Exchange and Mart* magazine became a main national advertiser to the public in the 1970s.

John A. Burton recalls from his youth in the mid 1950s (pers. comm.) 'The increase in European trade and imports of wildlife were on a massive scale. Despite researching it, there is relatively little documentation of this, with few records of either the species or the volume. It was not until Mike Lambert and I started writing about the tortoise trade in the 1970s, and Tim Inskipp wrote about the bird trade, that there seems to be much awareness of its impacts. Cage birds such as waxbills from Africa were sold for as little as 5/- a pair (equivalent today to about £6) and wall lizard from Italy for as little as 1/- each (£1.20). Tanks containing a squirming mass of lizards were a common sight in London pet shops, and among the frequent wall lizards there were undoubtedly a range of other species mixed in. I, like most other people (including most naturalists) were not aware that this was likely to cause any problems, and as a ten-year-old bought green lizards and several wall lizards, which rarely survived for more than a few months. This trade is apparent from the books of Alfred Leutscher, one of my mentors in the 1950s and '60s, and a senior member of staff at the Natural History Museum (Leutscher 1952).'

The sale of hatchling terrapins from North America saw noticeable growth in the 1950s, often together with a small plastic bowl to keep them in.

Today, Greater London holds about 3.2 million or twelve per cent of the UK's twenty-six million households. The numbers of mainly exotic pet reptiles and amphibians being kept is becoming easier to estimate. The Pet Food Manufacturers Association produces figures each year (web-based data) showing for example that in 2010 almost half of UK households had a pet, with on average one in five households having a dog or cat. While indoor tropical or cold-water fish remain highly popular, at around ten per cent or one in ten households, reptiles and amphibians appear to have increased to around one in twenty-five households (2.4 per cent), close to that of rabbits and indoor birds. This is made up from tortoises and terrapins (0.9 per cent), snakes (0.4 per cent), lizards (0.5 per cent) and amphibians (0.6 per cent). Very roughly, at present around 80,000 London households hold up to around 150,000 captive reptiles and amphibians. The UK level of exploitation can be compared with the USA where keeping of herps appears to be nearly twice as prevalent. In 1998 an estimated 3.9 million households (four per cent of total) held an estimated nine million reptiles and amphibians (Franke and Telecky 2001). Japan, another island with large populated cities, is reported to have 80,000 reptile keepers in fifty million households in 2006, roughly half the ratio of the UK. European figures however, appear to be unavailable.

There was thought to be a near doubling in UK herp keeping from 1996 to 1998, partly a response to the improving economy and disposable incomes, the availability of cheaper cages and equipment and the position of reptiles as a substitute to the diminishing sale of wild-caught birds. There has been a second noticeable increase since 2005. There has been stimulation of trade by the entertainment industry promoting of reptiles and dinosaur imagery that has been taken up by the toy manufacturing industry increasing the desirability of them to children. Use of exotic pets in advertising such as showing lizards in glass tanks, combined with their image within nature programmes as beautiful and mysterious has produced interest that has transferred to making personal possession of them more common. One recent TV advert (for HSBC) has even shown a family moving home and abandoning their snake in their garden as they leave and then getting a new one for their new home. WA (author) as a teacher has evidence that some parents may choose the hypoallergenic nature of reptiles and amphibians — no fur or feathers — as a reason for buying their children pet reptiles, together with the misapprehension that they need less care than mammals and birds.

Background

Archaeological and taxonomic considerations

There are a few issues concerning the origins of the current British herpetofauna that remain unresolved and some details remain sketchy. One has been the subject of debate since the 1840s. The reconstruction of the historic herpetofauna of Britain since the last post-glacial period has not been published but there are a number of papers addressing those species that were present during the Holocene period and there are numerous sites where excavation of stratified deposits in caves and at other locations together with radiocarbon dating have revealed evidence of past faunal assemblages.

Information from dozens of archaeological sites around Britain that contain amphibian bones deposited since the last Ice Age, consistently reflect occupation by those species that are presently extant. For herpetofauna, the exception is a claim based upon two relatively recent heavily human occupied coastal sites from the Middle to Late Saxon period. These are for frog bone material from up to three frog species (Gleed-Owen 2000). There has been disagreement between experts in the field and the identity of the material remains uncertain and in need of independent scrutiny.

Generally, UK vertebrate bone deposits reveal a consistent assemblage of species, together with a proportion that have become extinct in Britain but that today inhabit the slightly warmer habitats of 'mainland' northern Europe. The London Area, like the rest of England, was colonized after the last glaciation by a range of species, that moved north with increasing temperature after the last Ice Age. This was at a time when eastern England was contiguous with Germany and southern Scandinavia and prior to the English Channel forming, with the gradual shrinkage and submergence of the Doggerland island around 8,000 years ago. The amphibian and reptile species found previously, yet now no longer present, include those that have had fragmented distributions in northern Europe as a result of climate, such as the European pond terrapin *Emys orbicularis* that is recorded in the sub-fossil record in Denmark (with Aesculapian snake) around 7,000 years ago. Generally the length and intensity of spring and summer temperatures dictates their ability to breed and feed.

Climatic and zoogeographic considerations

It is important in a description of London's non-native herpetofauna to consider the conditions required for the survival of these species. Climate change awareness has recently become a dominant factor in environmental protection.

Changing weather patterns bring alterations that can have huge evolutionary significance. Probably the first analysis of temperature as a limiting factor in distribution of herpetofauna is that of Sweden's amphibian and reptile fauna (Gilsen and Kauri 1959). Sweden is a country with similar species to England, albeit somewhat richer by virtue of a more Continental climate, as a function of it being part of the larger European land mass. As in Britain, species richness reduces towards the Arctic. In Sweden there are also similar historic trends in the loss of species over the last centuries, the nature of the surrounding North and Baltic Seas effectively giving south Sweden a degree of island-isolation from the south. Isolation and edge-of-range effects on species, in combination with land alteration by humans and human translocation of fauna and flora, mean that cautious interpretation is required. Further information on changing climate in Britain and movement of amphibians by humans is given in Appendix 1.

Wildlife trade

An early reference to importation of wild-caught non-native herps as pets to London and Britain can be found in *A natural history of Jersey* (Le Sueur 1976). The impending importation of reptiles is recorded in the 1760s with Jean Simon, a general merchant in Jersey writing to his son in England 'regarding the lizards — as it is no longer hot they are out very little, but if there is a boat going from here to London I will collect some for you'. Presumably these were green lizard or wall lizard. The pet trade that developed was prohibited by the Jersey government in 1947. This followed increasing intensity of collectors visiting Jersey. It reached an unsustainable level and controls were one of the earliest actions to prevent over exploitation of wild animals taken for the pet trade. Around that time, concerns regarding the uncontrolled taking and selling of wild animals were being more widely discussed in Britain.

Since around 1970, nature conservation awareness has grown in Europe, with national legislation being put in force. Over the same period and more recently in most countries, measures have further increased as a result of the European Economic Community Directives and Regulations. International Conventions, such as the Convention on International Trade in Endangered Species (CITES), have raised concerns regarding over-exploitation.

Legislation relating to restrictions in the trading of wild-collected animals had generally reduced much of the large-scale exploitation between 1970 and 1990. However, since then changes appear to have allowed the opening up of trade so that more species are available and in increasing volumes. Unfortunately, trade forces of a kind found in any commercial process have resulted in illegal trade, rule-bending and pro-trade techniques that apply to many kinds of restricted goods. Around the world domestic 'consumption' of animals for food, as live animals for trade and as components of souvenirs or potions, creates a problem that is as bad if not worse than the gradual loss of rare animals; the wide-scale depletion of commoner or more widespread animals.

There is also a growing debate about how to address the spread of non-native species and a range of views have been expressed. Considerations of these includes, but goes beyond, issues relating to reptiles and amphibians and are not dealt with to any degree here.

Species accounts — reptiles

European lizards and snakes

*c.*10 records inside, <10 records outside LNHS area.

WALL LIZARD *Podarcis muralis* (Figure 3)

Wall lizards were sold widely not only as pets but for school/laboratory use until the 1970s. They have also arrived accidentally within imported goods and escaped or were released. They seem dependent on the warm microclimate provided by

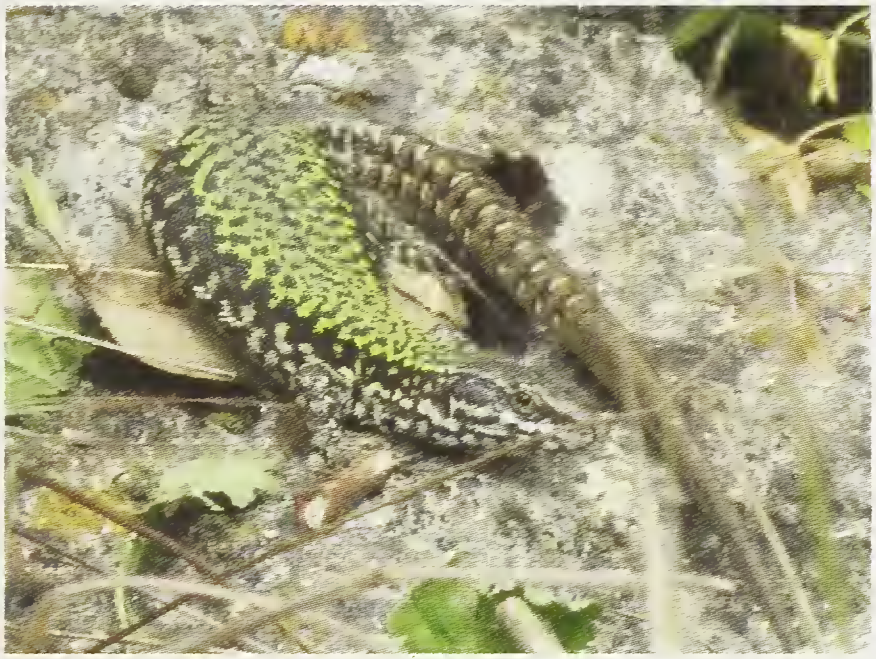


FIGURE 3. Wall lizard basking in the London Borough of Greenwich. *Photo: John Webb*

stone and rubble features, including old sunny walls with gapped rather than sealed mortar joints. Here they find safe retreat and egg-laying sites. Heat absorption by rock acts like a storage radiator and extends their daily activity period; they can be active throughout the year on sunny days on the south coast. Wall lizards have persisted for several years, or even decades at release sites but have not spread to any significant extent due to the lack of the particular warm conditions that they require. Colonization to distances of around 2,000 metres may be possible in areas with contiguous habitat and favourable microclimate such as on the Poole/Bournemouth cliffs in Dorset, where they have spread. This has possibly led to localized reduction in native sand lizards (BBC 2009). Many of the UK populations appear visually to resemble the subspecies *Podarcis muralis maculiventris, nigriventris* or *bruegemanni* originating from north-west Italy.

A national wall lizard project listing UK colonies past and present is run by the Surrey Amphibian and Reptile Group (SARG) and was summarized in print (Lever 2009). This has identified over thirty locations with small wall lizard populations and it estimates the UK numbers at over 20,000 animals. This number of locations reflects the unlawful (since 1981) release and spread of older releases of this non-native lizard along the south coastal cliffs and slopes of England by hobbyists. There is no evidence that this species will colonize London or spread over England widely even with future releases under current weather/temperature patterns although it can persist and spread locally if suitable conditions are created and maintained in gardened areas.

Our Society's members have commented on colonies in the LNHS area for some time. At the Beam Brook Nursery site in Newdigate, Surrey, wall lizards were established in the wild from the 1950s (Fitter 1959) and were present until around 1977, with individuals seen until the late 1980s. The first specific account of wall lizard in London was by Stiles (1979) in *The London Naturalist,* who recorded a population centred on an embankment and two railway bridges at Oldfield Road near Hampton Station in Richmond. They were reported in 1957 as already well established and were apparently reduced by repointing work on the bridges in 1973 although they were still present after twenty-one years in 1979 and could well have lasted thirty years or so. It is possibly the population in London, location unspecified, that is referred to by Edlin (1952).

There have, apparently, been wall lizards at the urban green spaces at Birdbrook/Kidbrooke in Greenwich since the 1970s, originating from animals bought locally at Well Hall pet shop. The colonization includes the release on the Birdbrook site of twenty-nine wall lizards obtained in 1978 by Charles Snell, a portrait artist, owning a garden backing onto the site (Snell 1981). They are reported to have bred on the Birdbrook site with a young lizard being found in 1980 from breeding in 1979. It was apparently not until the 1980s that they were found 800 yards away (on Kidbrooke Green). Snell has reported that three sand lizards *Lacerta agilis* found on Birdbrook had escaped from his garden (pers. comm. to TESL). This continuous occupation by wall lizards over what is now around forty years may be the longest yet recorded in London. The population at one point was thought to have reached 1,000 individuals, but the sites have changed and been reduced by development over the years and recent reports put numbers at around 200 adults.

Other than a few sporadic records from inner London boroughs from time to time, there are no other known established populations of wall lizard other than the Richmond and Greenwich colonies within Greater London although some small ones could exist. At the edge of the LNHS area there is however a population at the former biological supply base (Xenopus Ltd) site in South Nutfield (see later) in what is now a private garden. Here around 300 adults are believed to be derived from lizards obtained from Bologna in Italy by a trade supplier. Also within the LNHS area is a small population at Banstead, close to garden centre boundaries, thought to be around sixty strong and to have been present since around 2007.

In the mid 1960s, just outside the LNHS boundary, around a hundred wall lizards that were reported as surplus from a pet shop in Slough were released by Tony Phelps at East Burnham Common (Berkshire) in an area that is now a part of Burnham Beeches National Nature Reserve. There is no evidence that they survived for long. Wall lizards were released at Box Hill in the 1960s too and no doubt many other places at that time when they were available at low prices and where they died out unrecorded within a few years.

GREEN LIZARD *Lacerta viridis/bilineata* and SAND LIZARD *Lacerta agilis exigua* (non-native subspecies).

Despite the frequency of green lizard *Lacerta viridis* and western green lizard *Lacerta bilineata* in the pet trade, there are few records of survival in the wild although a population of *bilineata* is now established over a small area on coastal cliffs in Dorset. Here a population is thought to date from unlawful releases in the 1990s, though it was not widely reported until 2004. Within the LNHS area a green lizard was rescued by M. Offer and other LNHS members in 1961, when it was being stoned by children by the river in Kingston-on-Thames. It was probably an escaped or released pet. Fitter (1949) wrote of 'large green lizard' records in the wild from Godstone that were also reported to Malcolm Smith but not verified, and an introduction at Frensham, all of which do not seem to have been further reported. Sand lizards from Russia, *Lacerta agilis exigua,* were released at Noak Bridge in Essex in small numbers during the mid 1990s but did not remain and some of them may have been recaught (TESL, pers. obs.).

In general, non- native lizards from mainland Europe do not appear to establish well in the London Area. This is perhaps not just due to poor climate. The urban 'heat island effect' would be expected to favour the establishment of oviparous / poikilothermic species and while they can survive from year to year and some can breed, they do not appear to flourish. London's dominant 'cold' clay soils and limited 'dry' stone wall habitat creates constraints as much as our climate does. Lizards might otherwise expand along corridors such as railway lines, road verges and canals in the manner of our native lizards. Domestic cat and brown rat predation can reduce lizards to extinction, and collection and persecution of them by humans are other factors. One or two wall lizard colonies hang on, and there are occasional reports of individuals being sighted but nothing to suggest general persistence. The variability in common lizard coloration from dark grey and green, red, yellow, and black-coloured individuals can lead to the misapprehension that a non-native species has been seen. In short, it is considered unlikely that non-native lizard species will spread extensively in our area. Isolated populations may however continue to exist as long as they are 'gardened' by lizard enthusiasts.

Native species should obviously not be kept close to non-native lizards in captivity if they are to be released into the wild. There is, apparently, some circumstantial evidence that introduced wall lizard has caused the disappearance of native sand lizard *Lacerta agilis agilis* in Germany. On Boscombe Cliffs in Dorset there has been monitoring of the spread of wall lizard and western green lizard (Mole 2010). A new virus is reported to have been identified in wall lizard (BBC 2009). One theory is that it may be responsible for recent sand lizard decline and their removal may be required. Preliminary veterinary investigations are being considered (D. Bird, pers. comm.).

TESSELATED OR DICE SNAKE *Natrix tesselata*, VIPERINE SNAKE *Natrix maura* and non-native GRASS SNAKE *Natrix natrix* subspecies

Although the native grass snake was sold frequently as a pet until around 1980, non-native subspecies and the other semi-aquatic dice snake and viperine snake were also imported from mainland Europe for sale and were equally frequently released or escaped. Numbers of records are low, perhaps reflecting that anyone seeing them might assume them all to be native grass snakes. There are records of dice snake from Epping Forest by Malenoir from the 1960s (Malenoir 1963) and a single record of two viperine snakes at Joydens Wood in 1953 (Edwards 1953). There are records from the last fifteen years of dice snake and Italian grass snake *Natrix natrix persa* from Beam Brook Nurseries. There is no evidence of these species breeding, but interbreeding of grass snake subspecies might not be detected. Populations of non-native grass snakes or hybrid populations have been suspected in several places in the UK where striped or other unusually coloured grass snakes have been found. This year (2011) tests have detected a breeding population of the genetically distinct Romanian grass snake (although still regarded as being the subspecies *helvetica* like our native grass snake) in the Aire Valley in West Yorkshire.

AESCULAPIAN SNAKE *Elaphe longissima* [*Zamenis longissimus*] (Figure 4)

This large egg-laying ratsnake occurs in at least twenty-six countries in Europe with a small population in northern Iran (Gasc et al. 1997). It has been lost from one country, Denmark, where it was apparently quite common in the 1700s north

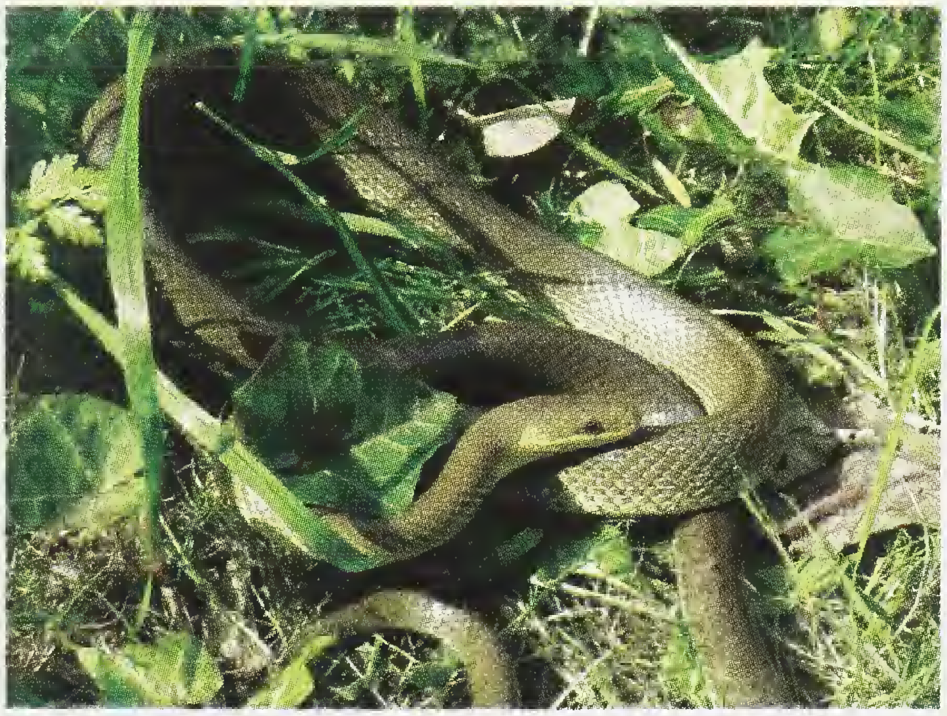


FIGURE 4. Adult Aesculapian snake at the canal location in London Borough of Camden. *Photo: Will Atkins*

of its main current range. In Denmark, relict populations are thought to have become finally extinct around 1863. Several other isolated populations are still found around the edges of its main range and are thought to be remnants of a former, much wider distribution, dating back to when the climate was warmer although human introduction could be a contributing factor.

Today, populations occur closest to Britain in north-west France. In western Europe there are several clearly introduced populations. In Britain a single site has been reported since the 1970s at the Welsh Mountain Zoo in Colwyn Bay, north Wales where a population of low hundreds of snakes has built up since the 1960s (Lever 2009) both within and some distance from the zoo. There they play an integral part in the local food chain and are also taken by many captive animals in enclosures. A second feral population has been extant since the mid 1980s along a canal embankment habitat in Camden, north London. This was first reported to TESL in 1998 by Ester Wenman, then head keeper of reptiles at London Zoo. Aesculapian snakes had apparently colonized the area during an experiment reported by the British Herpetological Society Legal Officer, Peter Curry, who was working there and keeping this species at the Inner London Education Authority Centre for Life Studies at the time that it was closed down around 1986. One account was that eight snakes had been released 'on the quiet' around the time of closure to try to form a population, several of which were recaptured, but some remained at large. Those caught initially were being euthanased but the view was then taken to leave the others 'to take their chances' where they were. Ten years later, in an aviary close to the embankment, fragments of juvenile Aesculapian snakes were found in a laughing thrush *Garrulax* sp. aviary, suggesting that the snakes had bred. Hatchling Aesculapians range from 120–370 mm body length. Breeding was not perhaps that unexpected in retrospect due to the hot dry summers of the late 1980s and mid 1990s when egg incubation could have been successful, especially since the snakes seek artificial warmth-producing sites such as manure and compost heaps in a similar manner to grass snake. In addition to the suspected 1995 breeding, a young snake was found in June 1999 at 250 mm total body length; suggesting a hatchling from the previous autumn (1998). Several newly born snakes were found in the basement of a building around thirty metres from the embankment in 2010 and breeding in that year was also shown in 2011 with a young 2010 cohort snake being located. To date this is the only example of a non-native snake species breeding successfully and forming populations in the wild in London and the UK as a whole.

Further observations

Detailed observations of adult snakes and including the young from 1995/1998 have been made at the location (by WA) between July 2007 and Sept 2010 and since then, in 2011 along 1.1 km of canal bank. To date around thirty different adults have been identified using the snakes' unique head-scale patterns and photography. Over this period the first and last season records for any year were 26 April (2010) and 30 September (2007). The air temperature during sightings were; lowest 19°C and highest 24°C. Of the thirty records, there was only one in April, in May seven records, June eleven, July four, August three, and in September four, suggesting a restricted active season peaking in June of only around five months in the cooler climate of northern Europe. Several mature snakes were found three years running in the same patch of habitat/bush at set times of year, although they may range more extensively at other times and a few individuals were seen at distances of up to 300 metres from original positions. Most were observations of older snakes in low bushes, inactive and basking in partial or full sunshine. Several observations were made of snakes partly hidden in semi-shade along the ecotone between denser scrub and wooded slopes and the more-exposed grassland.

Almost all observations were of snakes on the southern — i.e. north-facing side of the canal, often in moderately dense secondary woodland of hawthorn, birch, oak and horse chestnut originating from formal planting with bramble and bare patch understory. This use of wooded habitat corresponds with that reported as favoured in its natural range. Lack of observations on northern, i.e. south-facing bank is possibly observer bias due to difficult access and denser vegetation on that side of the canal. Almost all snakes when located were inactive and basking. So far no clear mating, hunting or feeding behaviour has been seen. One female was seen on leaf mould in June exploring, perhaps prospecting for an egg-laying site, and in July 2011 a female which had recently laid eggs was seen. There is a large heap of leaf mould next to the old Education Centre building and several rotting tree stumps along banks of the canal and manure heaps/compost heaps in the vicinity. No signs such as eggs or old eggshells have been found or reported. One adult was known to have crossed the main canal, presumably by swimming rather than using a footbridge. One adult was also seen at twilight during a guided bat walk. Reduction in snake sightings in high summer was thought perhaps to be due to snakes becoming more arboreal to compensate for canopy closure in wooded areas, or simply because high stands of bramble, nettle and hawthorn scrub make observations more difficult. There is evidence now that some have dispersed to be found in a new parkland area across a busy main road and around 500 metres away from the initial release area.

In the recent study, snakes were mainly of mature animals ranging from 700–1,500 mm in length; however lack of scope to place survey refuges may well have led to underestimate of juvenile snakes, which are often found sheltering under artificial sun-warmed materials. With respect to diet, one snake dropping was analysed and found to contain mouse hairs. Lizards, which are reported to form part of the juvenile diet, are not present on the canal, but common frog (breeding in the Zoo's Cotton terrace and wildlife pond) and nestling mammals may be available for hatchlings to eat. One snake was found in an empty bird's nest in June, but there was no direct evidence it had fed on eggs/nestlings. Snakes were observed by keepers (pers. comm. to WA), to be attacked by magpies regularly. A small rodent was seen to be taken from a snake by a magpie outside the Education Centre (zoo volunteer, pers. comm. to WA). Young brown rats may be a source of food for snakes in zoo and canal situations. A healed wound showed damage to the neck of one snake, possibly caused by a fox, cat, brown rat, or corvid, or by the action of grounds maintenance machinery.

Public awareness of the snakes has been allowed to spread through internet sites that encourage collecting and keeping reptiles as well as by mention in publications. The population is likely to be limited through collection, persecution, inbreeding, lack of egg-laying sites, or extreme events such as fire and isolation. The small population with its apparent current expansion warrants further study.

Non-European lizards and snakes

With LNHS recording of released and escaped pets and laboratory animals in the last century, the number of records was relatively low. Yalden (1965) produced a short list of species arriving from overseas having hidden in commercial goods such as typewriters and being detected without the animals getting into the wild. Today hardly a week goes by without a small amphibian being found in a bunch of grapes or lettuce in a supermarket; just about any small animals can appear anywhere at any time although most fail to reach the wild. Animals find their way back from foreign lands in suitcases too. Most are the smallest and commoner species. There seems little point in documenting the large number of reported escaped species. These now struggle to achieve a line in local newspapers, which earlier they often did. There are any number of snakes and lizard escaping, mostly inside houses but in summer months leaving through open doors and windows into gardens. Some are found in cars in garages, others in public parks, and most slowly starve if they are not located. The internet is a rich source of information, showing how casual the appearance of non-natives has become. As one web blogger indicated 'I don't think it is surprising that there are so many alien herps knocking around in Essex. Essex is a bit like Miami — it was once (and still is to a degree) the reptile importing centre of the UK. Having grown up there it always amazed me how many importers and animal dealers (including fish, birds, etc.) there were in eastern London and out into Essex, especially along the arterial road to Southend. It's not surprising with so much availability of species that there are so many escapees/ releases in the county over the years. I was once told of a whole shipment of *phelsumas* (geckos) that broke when it arrived at a shop, resulting in day geckos wandering around Benfleet for quite a few months in the early 1990s.'

There has been an almost brutalization of the public into seeing small exotic animals as a desirable yet often disposable commodity (see for example *Essex Jungle,* Channel 5TV, May 2011). This has moved on to a point where proliferation of them as a short-term novelty is considered acceptable and effectively, with the formation of selective breeding of colour morphs into a true 'fancy' with all the quirkiness of budgerigar and miniature dog breeds, based on unusualness and rarity (Bartlett 1987). This is despite the behavioural and physiological needs of particularly reptiles being far more subtle than many or most other species.

Some of the more regular escapes and abandonments are of iguanas. People like iguanas, perhaps because they look to some extent like dinosaurs, but they are not suited to Britain, and it is very hard to give them enough room in a house even when a whole room is devoted to them. They can reach over 1.5 metres in length and are not easy to keep as they mature. Many are abandoned or given up to specialist rescue centres including those run by the RSPCA which receives an annual average of one call a day relating to iguanas. They need a lot of room as well as heating. They are usually imported from Central America and Mexico at around six months old, and are attractive, with vivid colours. Adult male iguanas can also be aggressive. Males have a strong mating drive, which becomes apparent from the age of two years, and they may periodically try to mate with female humans, this includes powerful and painful biting and scratching. The RSPCA uses specialist rescue centres for iguanas, but there is not always enough capacity and they are often euthanased. Owners may abandon iguanas in open spaces if rescue centres cannot take them, but this leaves the iguanas to die from hypothermia and starvation, since they are not adapted to our climate.

Tortoises

Tortoises of the genus *Testudo,* mainly spur-thighed tortoise *Testudo graeca* and Hermann's tortoise *T. hermanni,* but also Horsfield's tortoise *T. horsfieldii,* were imported in hundreds from the late Victorian period (RSPCA 1979) and probably in quantities of several thousand each year. By 1938 over 250,000 were imported per year, many of them juveniles. They seem to have been the first widely sold non-native reptile pet and symbolized garden ownership and people at home during the day with the time to move them in and out according to the weather. Tortoise keeping was promoted from 1964 by the Blue Peter children's TV programme and demand escalated as a middle-class trend with an average of 200,000 tortoises recorded as imported per year in the 1960s and 1970s. This was an inhumane trade with high mortality at every stage and almost all dying within a few months (RSPCA 1979). It continued on a large scale until the ban on mass trade of European tortoises in 1984. CITES figures show that in the period leading up to the ban, between 1980 and 1984, 150,000 European tortoises were brought into the UK with many being crudely crated and dead on arrival. Many released in gardens escaped to uncertain fates. WA remembers seeing escaped tortoises on several occasions along the old railway line at Parkland Walk in Crouch End, Haringey in the 1980s. There are an estimated 15,000 tortoise keepers in the UK today of which perhaps 2,000 are based in Greater London. This means that on average tortoises are spaced about a kilometre apart from each other and probably around 500 metres apart in urban areas. A distribution map of them would effectively be the same as that of urban housing although many sadly are confined to glass tanks rather than larger secure and heated outdoor enclosures. A proportion, perhaps ten per cent, are free-roaming within gardens so effectively 'wild' albeit mostly unable to escape. From the mid 1980s a range of other species began to replace the European tortoises, with, for example, imports of box turtles *Terrapene* spp. from the USA reaching around 4,000 per year (Warwick 1987).

Tortoises struggle in the UK climate and require careful management. As one web blogger put it recently 'I cannot think it appropriate to keep a reptile which loves warmth, hates the rain (which drums on its shell), will not breed (unless kept in an indoor vivarium), hibernates from November to April and does not relish food for some time after waking or before returning into torpor. The way Gilbert White's "Timothy" would prop his body up against the garden wall to absorb as much of the weakening autumn sunshine as he could seems to say it all and suggests a creature that should be somewhere else.' Equally, a comment in the European herp field guide (Arnold et al. 1978) seems apposite 'unless they receive a great deal of care they live a travesty of their natural existence. The average semi-moribund captive tortoise bears no comparison with the alert, vigorous, herb scented beasts that plough through the undergrowth of southern Europe.'

Terrapins and freshwater turtles

The word 'terrapin' is a general one in British English language for freshwater chelonians with a hard external shell. This is unlike North America where the word 'turtle' covers all shelled reptiles, and the vernacular terms slider and cooter are used instead or in addition or for particular groupings of species as well as in species common names. In North America and elsewhere, compared with Europe the variety of species is much larger. In the UK, the word 'turtle' tends to be mainly used in reference to marine chelonians, with 'softshell turtle' a reference to species with a soft surface that feels and looks like rubber. The term 'freshwater terrapins and turtles' covers the two principal non-marine groups.

The terrapin trade, like the tortoise trade, has seen restrictions since the original mass importations. Initially the predominant species in trade and released into the wild in London and the UK was largely the red-eared terrapin *Trachemys scripta elegans*. Following import restrictions within the European Union in 1997 a wider and growing range of look-alike or substitute species have replaced them, originating from around the world, including species from Australia, Africa, Asia and the Americas. Today in the London Area we have identified at least twenty-two different types of terrapin, mostly species or subspecies but some intergrades and hybrids that are the result of breeding in captivity and illegal abandonment by the public. Table 1 lists the types that have been identified largely from photographs, reliable accounts and recaptured individuals. There are at least a further seven types including several subspecies and possibly many more that are present elsewhere in the UK and with probable or possible reports and sightings within the London Area but as yet no absolute confirmed record. The range and variety of terrapins released to the wild since the late 1990s is not picked up in the recent non-native species review by Lever (2009).

Figure 5 shows the distribution of all freshwater terrapin and turtle sightings in the London Area since records began around 1910, almost all of which are post 1980. This covers over 300 records over this period describing over 2,000 individual terrapins over the last thirty years.

The distribution of terrapin records is relatively even across the area and generally reflects the available aquatic freshwater habitat; ponds, lakes, other larger water bodies and the canals, streams and rivers of London. Locations reported include many Borough Council-managed parks and gardens, those larger open spaces managed by the Corporation of London, Royal Parks, English Heritage, and several nature reserves and wetlands centres run by charities such as The Royal Society for the Protection of Birds, The London Wildlife Trust and The Wildfowl and Wetlands Trust. Examples of those within the LNHS recording area to date are listed below. Those actively birdwatching are invited to include

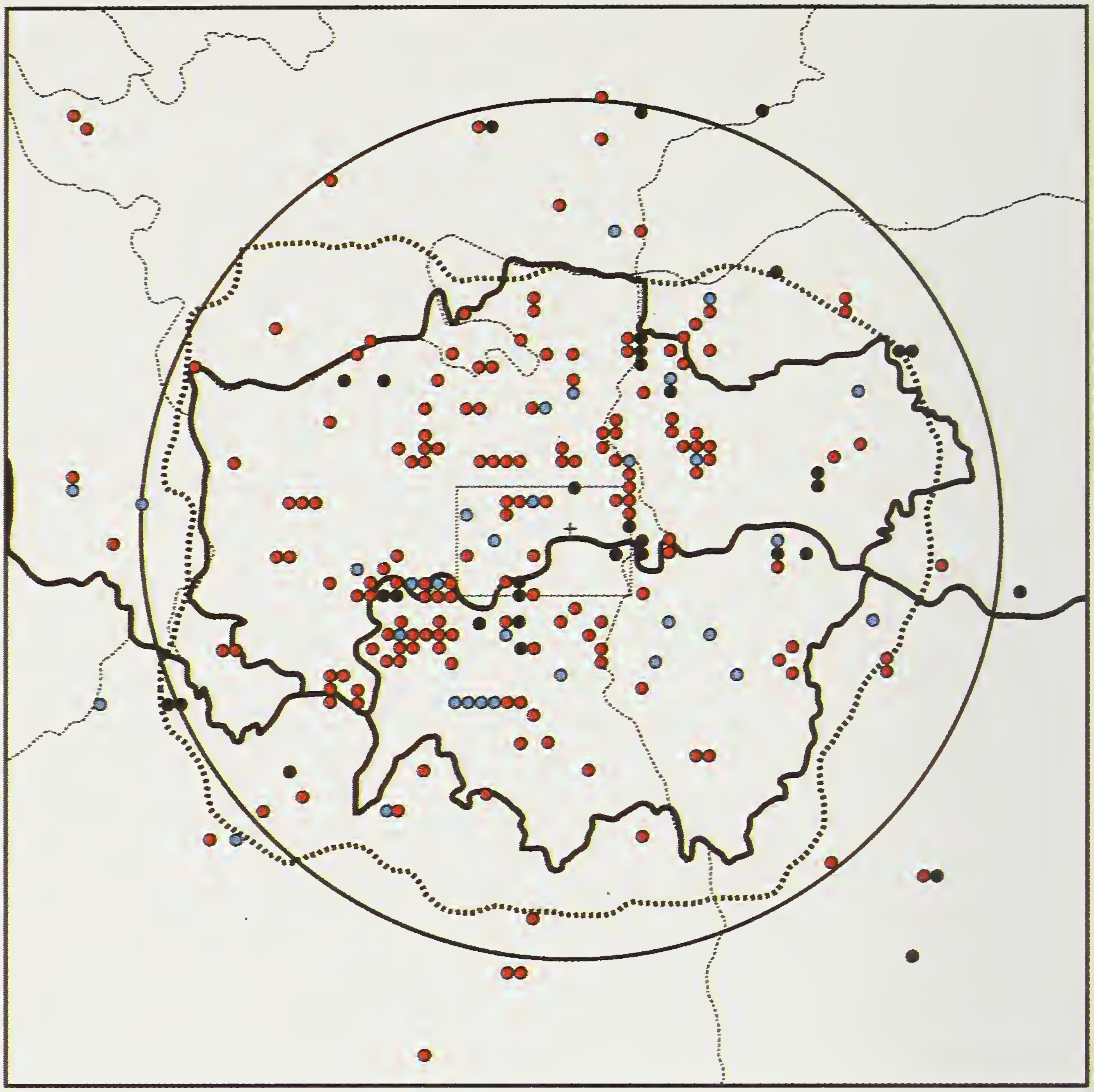


FIGURE 5. One-kilometre distribution records for freshwater terrapins/turtles in the London Area to 2011.

Red dots = 'red-eared type', Black dots = at least one non 'red-ear type', Blue dots = 'red eared type' and at least one other terrapin type.

the reporting of terrapins in their regular and one-off recording excursions and to encourage their friends to report them too, to the LNHS recorder for herpetofauna.

Examples of park, reservoir, river and nature reserve locations with terrapin records within LNHS recording area are listed below. Many of the canal systems have multiple records over long distances:

Middlesex, Hertfordshire and Buckinghamshire: King George V Reservoir, William Girling Reservoir, Brent Reservoir, Hampstead Heath, Chiswick House, New River Walk, Lots Ait, Boston Manor Park, Middlesex Filter Beds, Canons Park, Gladstone Park, Fryent Country Park, Roundwood Park, Alexandra Park, Tottenham Cemetery, Camley Street Natural Park, Meanwhile Gardens, Regent's Park, Waterlow Park, Grand Union Canal, Gillespie Park, Finsbury Park, Carville Hall Park, Gunnersbury Park, Holland Park, Horsenden Hill, Kensington Gardens, St James's Park, Chelsea Physic Garden, Osterley Park, Bedfont Lakes, Grovelands Park, Watford Town Centre, Black Park. **Essex:** Epping Forest, Wanstead Flats, Highams Park, Clissold Park, Walthamstow Reservoirs, City of London Cemetery, Victoria Park, Canary Wharf, East India

Dock, Old River Lee. **Surrey:** Morden Hill Common, Mitcham Common, Lonsdale Road LNR, Rectory Park, Wandsworth Common, Bushy Park, Hampton Court, Syon Park, Ruskin Park, River Hogsmill, Battersea Park, Wandsworth Common, Chertsey Lake, River Wandle, River Quaggy, Tooting Common, Kew Gardens, Chislehurst Common, Richmond Park, Clapham Common, Epsom Common, London Wetland Centre Barnes, Cannon Hill Common, Sydenham Wells Park, Bushy Park, Mercers Park, Putney Heath, Wimbledon Common, Ham Common, Crystal Palace, Tooting Common, Kelsey Park, Ruskin Park, Bookham Common, Beddington Gravel Pit. **Kent:** Keston Ponds, Southmere Lake, Foots Cray Meadows, Greenwich Ecology Park, Canada Water, Dulwich Park, Lesnes Abbey Wood.

The number of terrapins at any one location reported ranged from one to 180 individuals. Sightings of two to ten terrapins were most frequent. The maximum number of terrapin types (species, subspecies or intergrades/ hybrids) present was six (Clissold Park, Hackney) and only twelve sites had four or five types recorded together and all of these where trapping revealed numbers rather than distant observation.

Table 1. Species of freshwater terrapin/turtle that have been reliably recorded within the London Area.

Red-eared terrapin	*Trachemys scripta elegans*
Yellow-bellied slider	*Trachemys scripta scripta*
RET/YBS hybrid	*Trachemys scripta elegans* × *Trachemys scripta scripta*
Other slider intergrades	*Trachemys* sp./ssp. × *Trachemys* sp./ssp.
Cumberland slider	*Trachemys scripta troostii*
Painted terrapin spp.	*Chrysemys picta*
American red-bellied cooter	*Pseudemys rubriventris* (see text)
Hieroglyphic river cooter	*Pseudemys concinna hieroglyphica*
Cooter/slider hybrids	*Trachemys* sp. × *Pseudemys* sp.
Diamondback terrapin	*Malaclemys terrapin*
Common snapping turtle	*Chelydra serpentina*
False map turtle group	*Graptemys pseudogeographica* group
Black knobbed map turtle	*Graptemys nigrinoda*
Ouachita map turtle	*Graptemys ouachitensis*
Common musk turtle	*Sternotherus odoratus*
European pond terrapin	*Emys orbicularis*
Spanish terrapin	*Mauremys leprosa*
Chinese softshell turtle	*Pelodiscus sinensis*
Spiney softshell turtle	*Apalone spinifera*
Unidentified softshell turtle	*Apalone/Pelodiscus* sp. (not Chinese or spiney)
Snake-necked turtle	*Chelodina/Macrochelodina* spp.
African helmeted turtle	*Pelomedusa subrufa*

Table 2. Other species of freshwater terrapin/turtle with wild sightings or captures elsewhere in the UK and probable or possible reports and sightings but no confirmed record within the London Area. Some of these species stay almost permanently hidden from view.

Eastern river cooter	*Pseudemys concinna*
Florida red-bellied turtle	*Pseudemys nelsoni*
Peninsular cooter	*Pseudemys peninsularis*
Razorback musk turtle	*Sternotherus carinatus*
Alligator snapping turtle	*Macrochelys temminckii*

The following accounts and descriptions will hopefully assist those interested in recording and reporting these species. Please report any further sightings to the LNHS recorder for amphibians and reptiles.

RED-EARED TERRAPIN (RET) *Trachemys scripta elegans* (Figure 6)

See Frontispiece.

100s of records inside, *c.*10 records outside LNHS area.

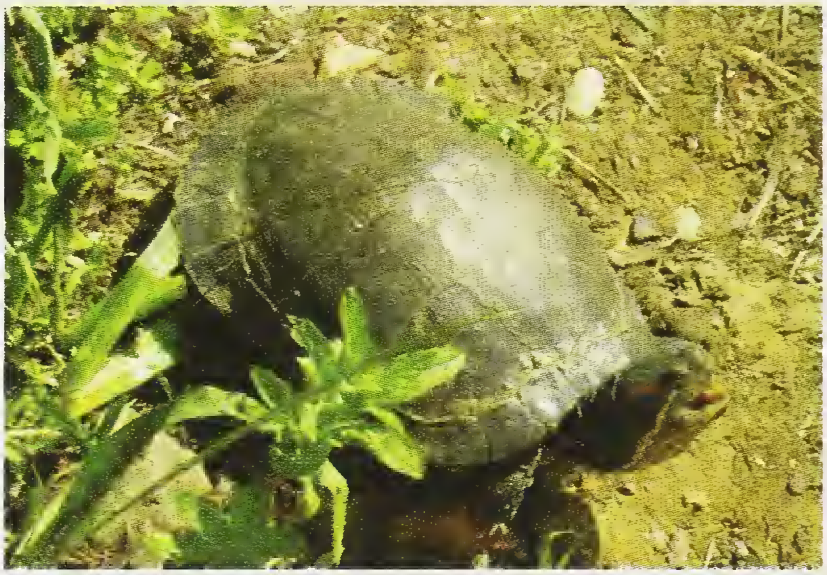


FIGURE 6. Red-eared terrapin on land at Sheepwash Pond, Barnet in 2006. *Photo: Liz Barrett*

Also called red-eared slider, this is the most frequently released and reported species and it represented most of the pet terrapin trade until around 1997 when lookalike species were substituted. It has a noticeable red bar or ear behind its eye that can be variable in size, shape and colour. It can be confused with the rarer Cumberland slider that also can have an orange/red two-tone eye bar. Hybrids and intergrades may or may not retain some kind of 'ear' marking. Together these are referred to as 'red-eared type' terrapins, to take account of the difficulty in distinguishing them. Upon close inspection and with good photographs most are currently 'pure' red-eared terrapins. When young, like many terrapins, red-eared terrapins have a more carnivorous diet and feed on fish fry, amphibian spawn, tadpoles and adults and invertebrates. Some aquatic plant material is also taken but when adult they become mainly herbivorous although they will continue to take carrion. In one London park terrapins began feeding on bread that was being thrown for ducks.

Occupying freshwater wetland habitats, and originating from central and southern USA, it is a species that has become established around the world as a result of captive breeding and ranching and its subsequent mass sale and abandonment. This species has been wrongly accused in the press of attacking ducklings and other small wildlife (e.g., Yapp 2004, Lloyd 2005) often when other predatory species such as northern pike *Esox lucius* or the introduced wels catfish *Silurus glanis* are more likely to be responsible (e.g., Anon. 2005*a*). In consuming quite large amounts of vegetation, however, the species may alter smaller pond ecosystems. At Sheepwash Pond in Barnet it was loss of condition in the previously varied aquatic plant community that in part instigated the concern for terrapin removal (local volunteers, pers. comm.) although it was not proven that the terrapins had played a role in significant change to vegetation.

YELLOW-BELLIED SLIDER (YBS) *Trachemys scripta scripta* (Figure 7)

See Frontispiece.

The yellow-bellied slider is very is closely related to the red-eared terrapin but with no red ear mark. There is a diagnostic yellow-coloured 'S'-shape marking running from behind the eye down to the lower side of the neck. Its origin is the south-east USA. Diet is the same as red-eared terrapin.

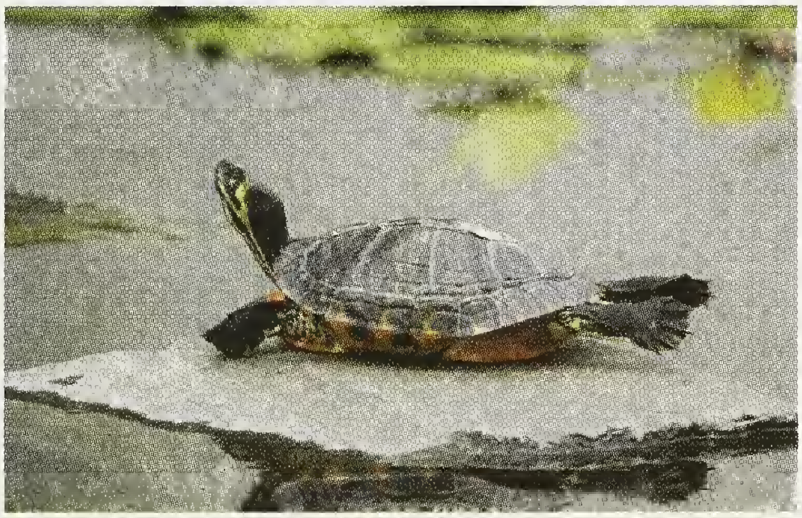


FIGURE 7. Yellow-bellied slider with some cooter characteristics. This individual may be the result of cross-breeding in the wild or captivity prior to sale as a pet and its abandonment.
Photo: Liz Barrett

RED-EARED × YELLOW-BELLIED intergrade *Trachemys scripta elegans* × *Trachemys scripta scripta* (Figure 8)

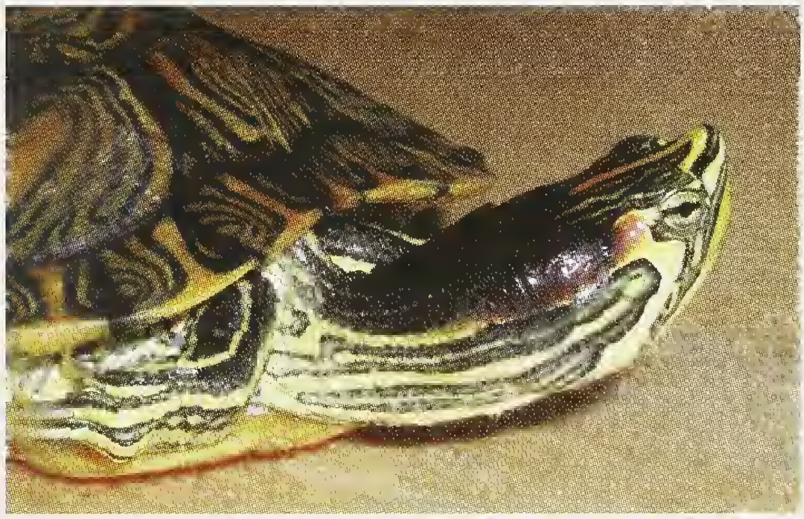


FIGURE 8. This red-ear × yellow-bellied intergrade shows the yellow 'S' shape of yellow-bellied slider and the red 'ear' of a red-eared terrapin. *Photo: Roman Muryn*

Other intergrades/hybrids *Trachemys scripta troostii* × *Trachemys scripta scripta* (Figure 9)

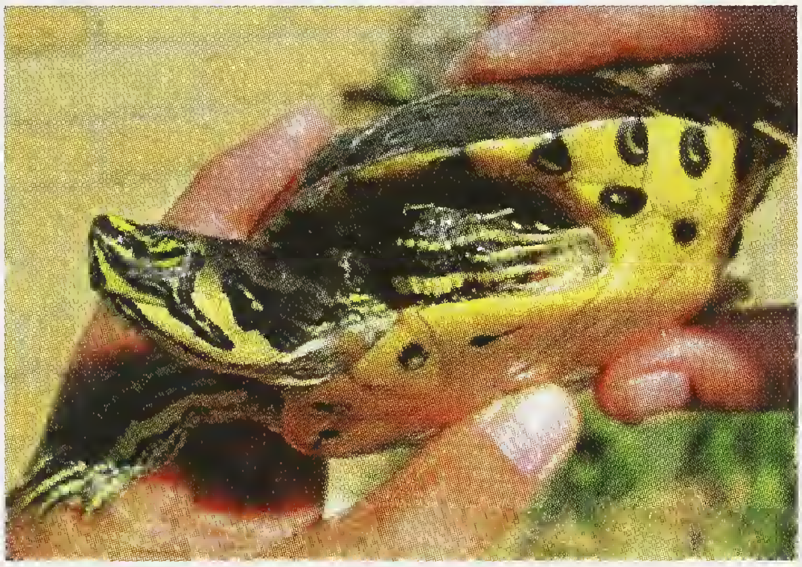


FIGURE 9. This male *Trachemys* is probably an intergrade and appears biased towards a Cumberland terrapin *Trachemys scripta troostii*. *Photo: Tom Langton*

CUMBERLAND SLIDER *Trachemys scripta troostii*

A semi-aquatic species found originally in east-north-eastern Tennessee and the extreme south-western corner of Virginia. Also released elsewhere in south-east USA and found in trade but mainly as intergrades. This species prefers quiet ponds, lakes, and streams with lots of aquatic vegetation and muddy bottoms. It is primarily carnivorous as a juvenile and omnivorous as an adult.

PAINTED TERRAPIN *Chrysemys picta* (Figure 10)

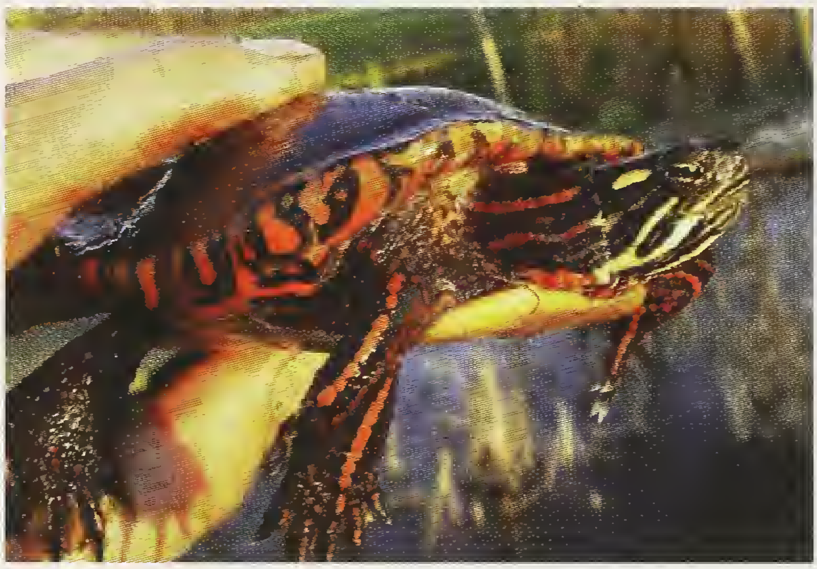


FIGURE 10. Painted terrapins can have very vivid red markings on their shell and neck. *Photo: Roman Muryn*

This is the most widespread native terrapin in North America, occurring in slow-moving fresh waters, across the entire continent from southern Canada to northern Mexico. Its diet includes water plants, algae, small invertebrates and fish fry.

COOTER; *Pseudemys* type, including RIVER COOTER *Pseudemys concinna* (Figure 11), the NORTHERN or AMERICAN RED-BELLIED COOTER *Pseudemys rubriventris*, FLORIDA RED-BELLIED COOTER *Pseudemys nelsoni* and HIEROGLYPHIC RIVER COOTER *Pseudemys concinna hieroglyphica.*

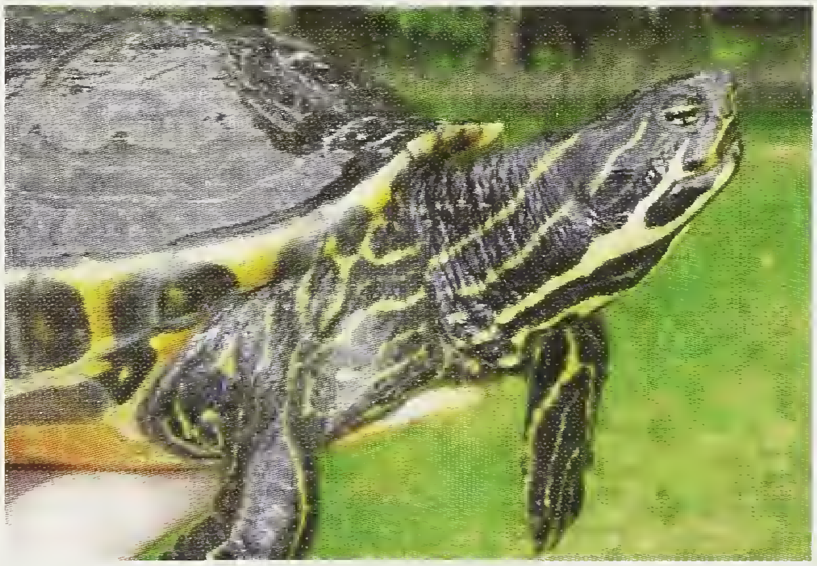


FIGURE 11. River cooter *Pseudemys concinna.* *Photo: Roman Muryn*

The cooter carapace is not highly domed. It can have brown or yellowish markings, and the pleural (side) scutes can have C-shaped marks. Older males may become very dark obscuring earlier pattern. Hatchlings have a central keel which disappears with age. There are a range of cooter subspecies throughout the USA where they occupy rivers, lakes and a range of wetlands and coastal areas and there are several declining types. Often largely herbivorous, they are opportunistic and have tooth-like cusps in the upper jaw for crushing leaves and fibrous aquatic and terrestrial plants. They will eat fallen fruit as well as forage for small fish.

DIAMONDBACK TERRAPIN *Malaclemys terrapin*

The diamondback is native to the brackish coastal swamps of the eastern and southern United States, from Cape Cod south to Massachusetts to the southern tip of Florida. It reaches around the Gulf Coast to Texas. Diet includes molluscs, crustaceans and small fish. This is a rarer species that commands higher value in trade.

COMMON SNAPPING TURTLE *Chelydra serpentina* (Figures 12 and 13)

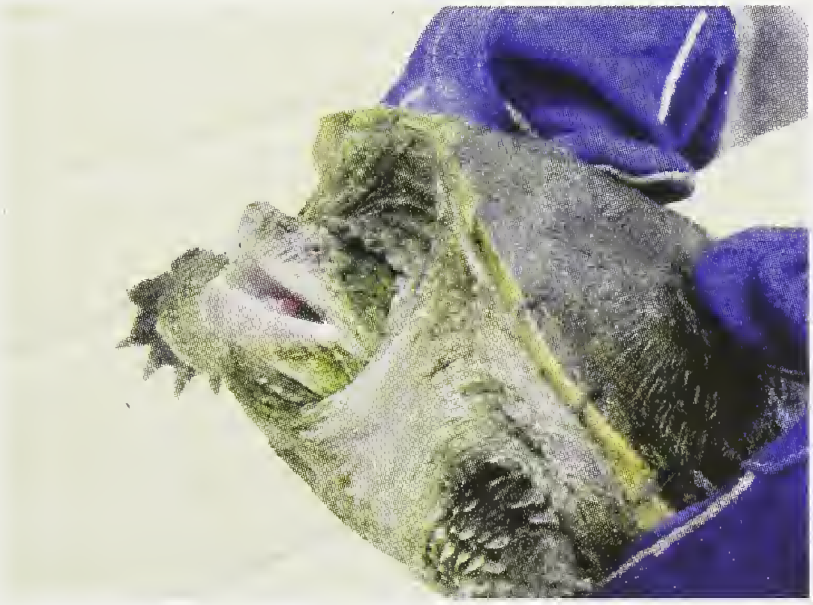


FIGURE 12. Snapping turtle in captivity at a rescue centre under veterinary care. Some of the short fine lines on the carapace (shell) are parasitic worms. The green tint on the nose is caused by the disinfectant bath this turtle was being treated in. *Photo: Tom Langton*

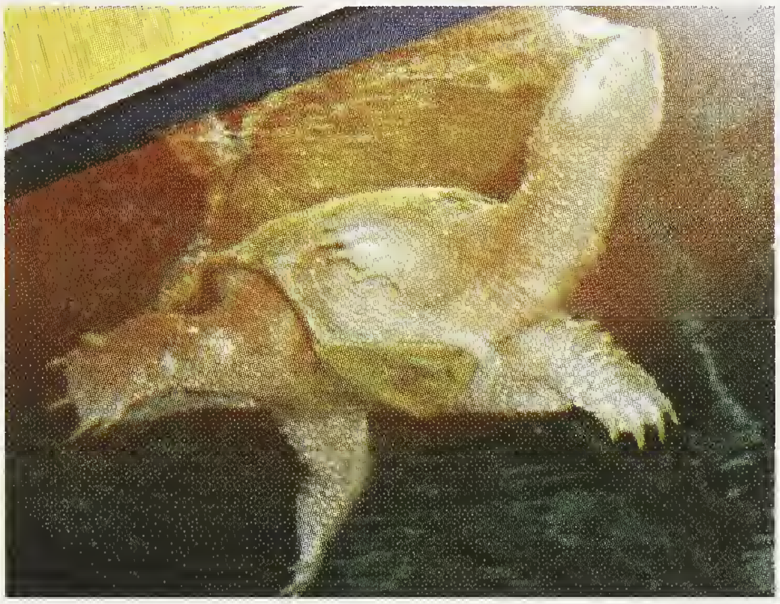


FIGURE 13. A common snapping turtle swimming, viewed from underneath showing reduced plastron and thick limbs and neck. *Photo: Roman Muryn*

Snapping turtles are large freshwater species, distributed from southeastern Canada to the Rocky Mountains. They are widely introduced outside their range in the USA and south from Mexico to Ecuador. They have powerful beak-like jaws and a dexterous elongated retractable neck. Locally in the USA they are frequently and probably increasingly hunted for use to make turtle stew/soup. They are dangerous to handle due to a very powerful bite and sharp-edged jaws. These turtles can live to approaching fifty years in captivity, while the lifespan of wild individuals is around thirty years.

Snappers live in shallow ponds, lakes and streams with tolerance of brackish conditions. They occasionally bask on trees and logs in the water but in the UK are seldom seen basking. In shallow waters, they may sit on a muddy bottom stretching their long necks to the surface to breathe, with the forward-pointing nostrils functioning as snorkels.

Snapping turtles are omnivores, consuming both plant and animal matter, and are important aquatic scavengers; but they are also active hunters that prey on anything they can swallow, including crayfish, fish, frogs and reptiles. This also includes juvenile and adults of the smaller terrapin species, and invertebrates, birds and small mammals. There is some indication that in some cases, once reaching around five years of age the species behaviour shifts and they become more predatory, killing and leaving prey for future consumption on the bottom of a water body and in this way may possibly influence small closed water-body communities more significantly.

The alligator snapping turtle *Macrochelys temminckii* is a large turtle not dissimilar in appearance to the common snapping turtle with a big head, up to 80 kg (176 lb) in weight and sometimes more. It is reported to be much rarer and occasionally the media will run scare stories about one being present or possibly present and to be taking large prey. There are unproven rumours of swans and small dogs being taken. There are media reports of possible wild alligator snapping turtles, including a BBC report in 2005 in the River Lea 'Boat trip fuels "river croc" tale', when a Canada goose was reported to have been dragged under water. The species appears to fetch a high price tag and in Essex is reported by one rescue centre to attract the persons who might also keep a dangerous dog as a status symbol. Although there is circumstantial evidence that alligator snappers have been released in Greater London and the LNHS/London Area in general we have not yet documented an authenticated record. They have however been removed from water bodies elsewhere in the UK in recent times.

MAP TERRAPINS *Graptemys* spp. (Figures 14–17)

FALSE MAP TURTLE	*Graptemys pseudogeographica pseudogeographica*
MISSISSIPPI MAP TURTLE	*Graptemys pseudogeographica khonii*
OUACHITA MAP TURTLE	*Graptemys ouachitensis*
BLACK KNOBBED MAP TURTLE	*Graptemys nigrinoda*

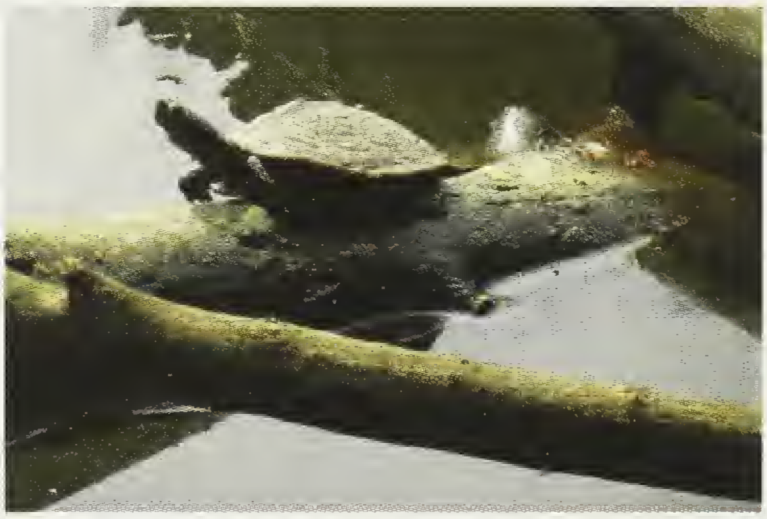


FIGURE 14. Unidentified *Graptemys* sp. at a Hampstead Heath pond, May 2011. This illustrates how shadow and light contrast can make exact identification at a distance very difficult. *Photo: City of London Hampstead Heath*

Graptemys is a genus of small aquatic freshwater turtles that are hard to identify without a close-up photograph or them being in the hand. Females can get up to female cooter size. They make up a small but significant component of terrapins being found in the London Area. They occur throughout the eastern half of the USA and in southern Canada and can have features resembling those of other species of aquatic turtle but are distinguished by a keel sometimes with serrations or knobs that runs the length of the centre of their carapace. They are sometimes also called sawback turtles although this name is less well used. The name map turtle is due to some having map-like fine line markings on the carapace although these are not always obvious. Map turtles are omnivorous and consume invertebrates as well as vegetation.

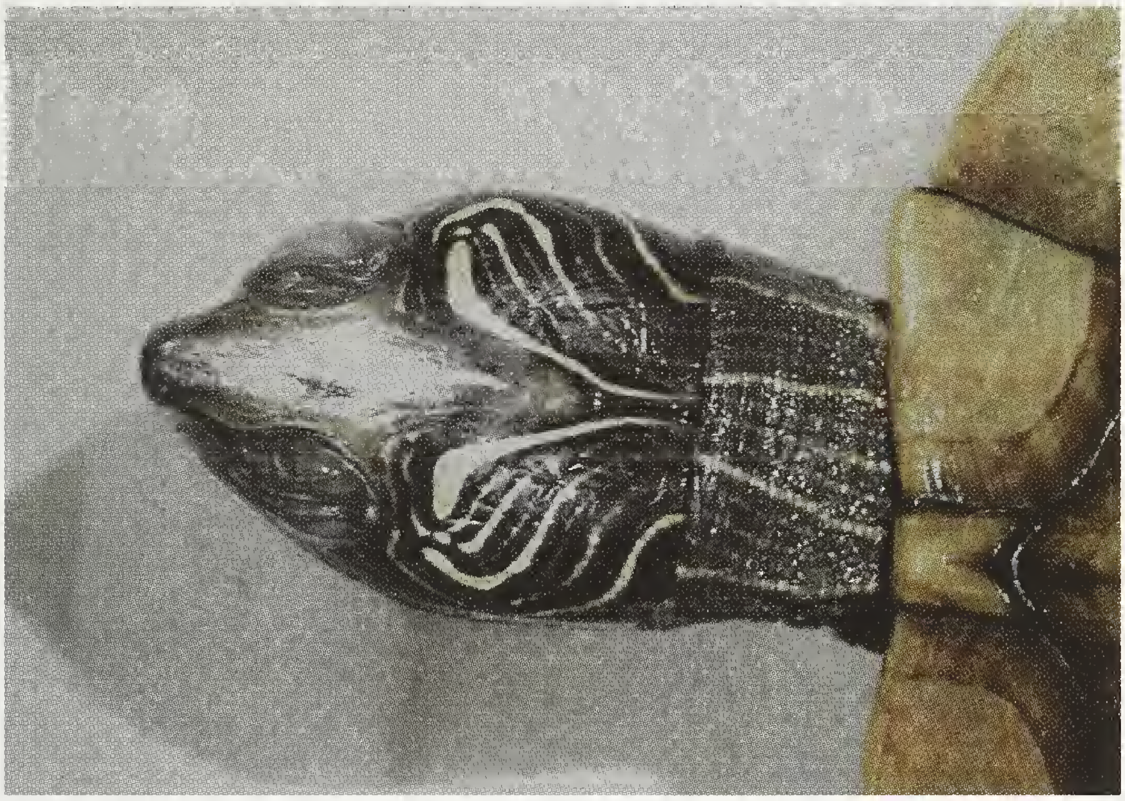


FIGURE 15. False map turtle *Graptemys pseudogeographica pseudogeographica* with two hockey stick-shaped marks on the top of its head. *Photo: Jo Jeynes*

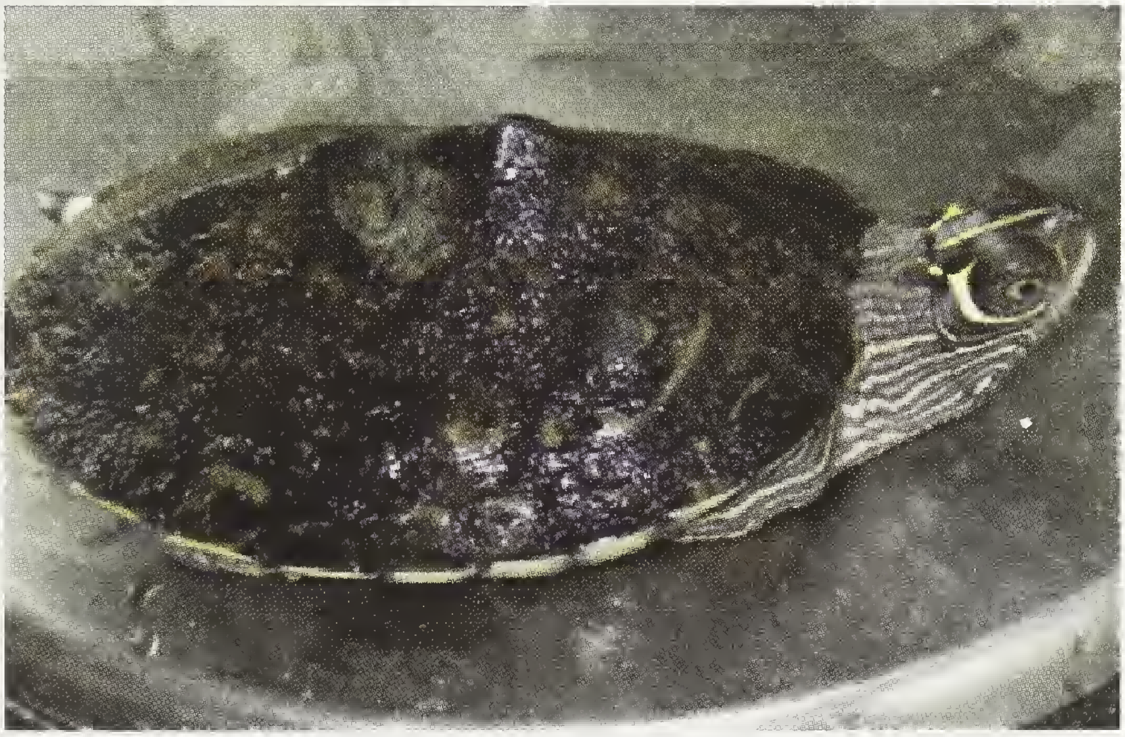


FIGURE 16. Mississippi map turtle *Graptemys pseudogeographica khonii* with crescent-shaped mark going under its eye. *Photo: Roman Muryn*

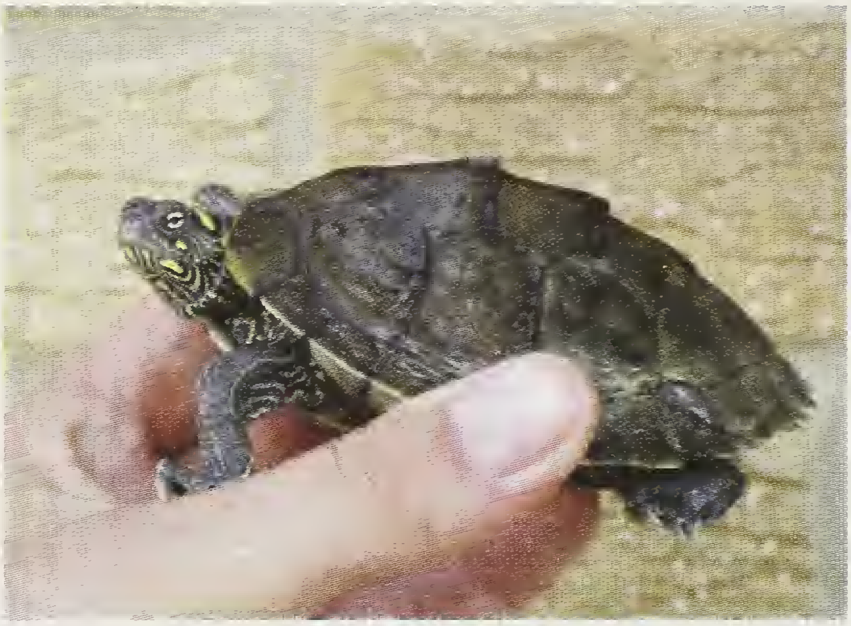


FIGURE 17. This capture resembles an Ouachita map turtle *Graptemys ouachitensis* with two bold face marks above and below the mouth. *Photo: Tom Langton*

The Ouachita map turtle, as with other map turtles, might be expected to survive better in the UK than others, it having a more northerly natural range. A further species, the black knobbed map turtle *Graptemys nigrinoda,* has been reported by trappers but is not currently thought to be commonly in trade. Sizes have been recorded as up to 100 mm in males and 190 mm in females. This species has been observed to consume beetles and dragonflies but diet includes a lot of vegetation, and animal food is reported to include freshwater sponges, bryozoans, and molluscs.

COMMON MUSK TURTLE *Sternotherus odoratus*

Widespread across North America, these small terrapins are carnivorous and have long necks assisting hunting of crayfish, clams, snails, insects, fish and carrion. Also called stinkpots as when threatened they can secrete a foul-smelling, yellowish fluid from musk glands under the edge of the carapace. This species likes to bask in shallow water, or amid floating vegetation, with the centre of its carapace exposed to the sun. Highly aquatic, these turtles rarely leave the water and hence are probably under recorded as they should survive in the UK climate.

EUROPEAN POND TERRAPIN *Emys orbicularis* (Figure 18)

*c.*10 records inside and 2 records outside LNHS area.

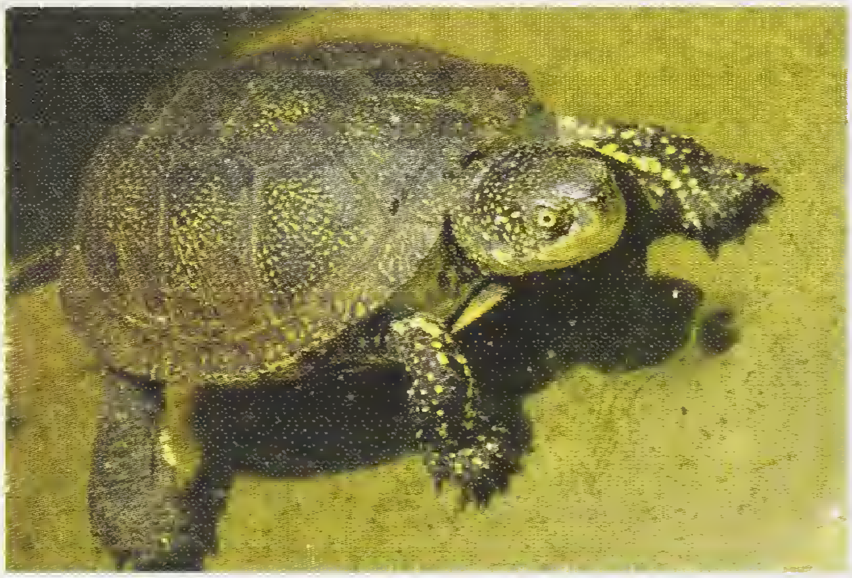


FIGURE 18. European pond (tortoise) terrapin. *Photo: Roman Muryn*

European pond terrapins are distributed across southern and central Europe, west Asia and North Africa and there are many subspecies. In the early post-glacial period, the pond turtle had a wider distribution, being found in the UK and southern Sweden. The species is considered semi-aquatic, and they can range on land up to 4,000 metres from water. As a common animal in trade until the 1970s there have been numerous attempts to establish this species in northern Europe and frequent garden escapes. Released animals may survive for some time but other than close to their natural range (including in the UK), any eggs laid outdoors do not get high enough incubation temperatures to hatch. Pond terrapins have been imported since Victorian times and two of the early releases in the London Area were at Shere and Frensham in Surrey (Fitter 1949, 1959). Yalden (1965) reported them as a common pet and subject to numerous attempts at introduction. Lever (2009) felt that nine terrapins caught in north Surrey in 1948 could be descendants of those released at Frensham before 1911, but there is no evidence for this and lack of UK outdoor breeding records suggests that this is unlikely. Lever's suggestion that with climate change it may become widely established depends on whether the climate gets hotter or colder. There is no evidence that the species is widely released any more nor that it survives very long once released. Its nearest natural breeding site in France is around 200 km south of Paris. Omnivorous, like other turtles its diet may become more herbivorous with age.

SPANISH TERRAPIN *Mauremys leprosa*

Colours range from orange-brown to olive. Young can have small orange or yellow markings on scales. Their plastron is yellow with a dark patch sometimes with a light line running down the middle. Their head and neck have a light striped pattern. They feed on small fish, amphibians, tadpoles and insects and sometimes on plants. Apparently tolerant of polluted water. There is a record of two individuals from a small pond at the Middlesex University site at Cat Hill.

SOFTSHELL TURTLES *Pelodiscus, Apalone* and *Trionyx* spp. (Figures 19 and 20)

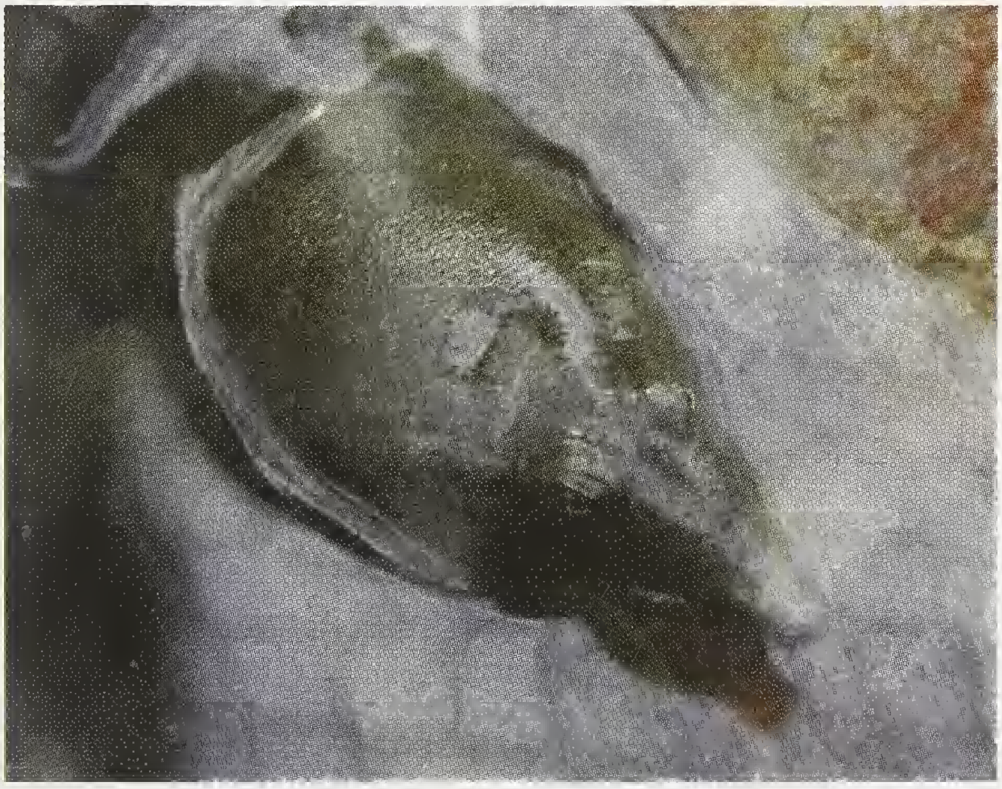


FIGURE 19. Softshell turtle captured at Sheepwash Pond, Barnet. *Photo: Liz Barrett*

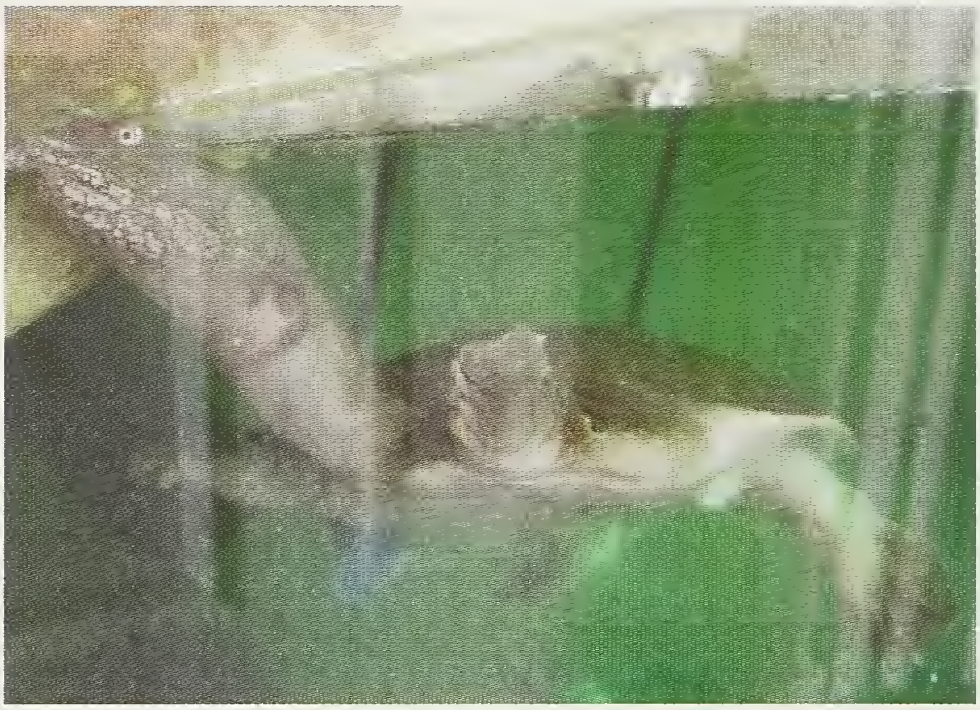


FIGURE 20. Softshell turtle recently caught from a lake north of Harlow.
Photo: Tom Langton

Apalone are North American softshell turtles and those appearing in trade and abandoned include *A. ferox* Florida softshell, *A. mutica* smooth softshell and *A. spinifera* spiny softshell, that were previously assigned to the North American species of the genus *Trionyx,* that still refers to some of the softshell species found in Asia. They are mainly piscivorous. The Chinese or Asiatic softshell turtle *Pelodiscus sinensis,* formerly known as *Trionyx sinensis,* has a natural range across China, Korea, north Vietnam, Japan, and Russia and is bred in captivity in massive numbers in China. Like the common snapper they often rest part-submerged in silt in shallow water, snorkel breathing and ambushing passing crustaceans, molluscs, insects, fish, and amphibians. Chinese softshells, like snapping turtles, replaced red-eared terrapins in the pet market and are substantially better adapted to cold climates. They probably represent a higher ecological impact; softshells are a very cryptic species and significantly more carnivorous than the red-eared terrapin.

AFRICAN HELMETED TURTLE *Pelomedusa subrufa* (Figure 21)

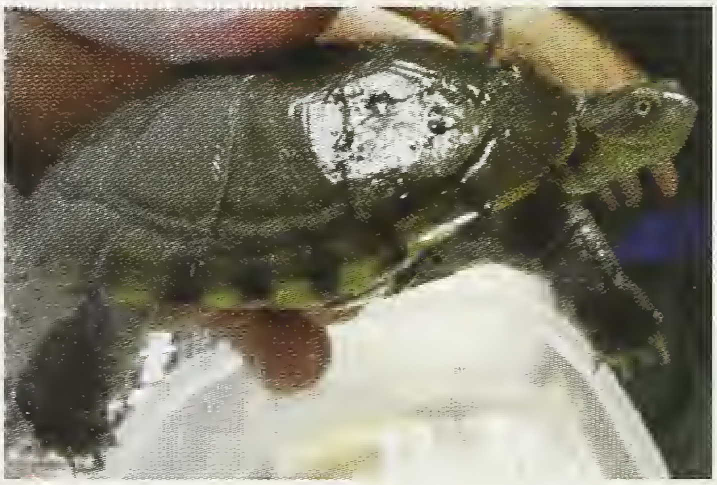


FIGURE 21. African helmeted turtle caught at Hampstead Heath, Camden.
Photo: City of London Hampstead Heath

This is a fairly widespread semi-aquatic African species living in rivers, lakes, marshes and temporary pools. Omnivorous, they will eat insects, small crustaceans, fish, earthworms, snails and carrion. They are reported to feed in groups at the water's edge by dragging and drowning small vertebrates. Due to its tropical environmental needs it is incapable of surviving a British winter.

SNAKE-NECKED TURTLE *Chelodina/Macrochelodina* spp.

Turtles that are native to Australia, New Guinea and the Indonesian archipelago with oval-shaped carapaces. They are side-necked turtles tucking their head around the side of their body when threatened rather than backwards into their shell. They are fish feeders and remarkably six individuals were reported as caught using a basket trap from one location in Harlow in 2011.

Basic freshwater terrapin and turtle identification in the London Area

Terrapins/turtles have very good eyesight and are naturally skittish. Most disappear into the water very quickly when you get within thirty metres or so. A good pair of binoculars is all but essential for viewing from the bank, or better still a good telescope or camera with telephoto lens. If water is clear, polarizing sunglasses may help when looking for them submerged under the water from the bank or from a boat. They are inquisitive and sitting patiently often is rewarded with their cautious reappearance. Most of the shelled animals seen in the UK will be American so the guides recommended are American.

The best starting book is *Turtles of the United States and Canada* (Ernst et al., currently 2009 edition) but it is quite expensive. The National Audubon Society's *Field Guide to North American Reptiles and Amphibians* is a good cheaper option. Also useful and cheap are the *Golden Field Guides — Reptiles of North America*. Be aware that the Latin names of some species have been reclassified recently. Note that terrapins from eggs incubated at too high temperatures and fed incorrectly can have malformed shell shapes and be hard to identify easily.

SLIDERS *'red-ear type'*

The terrapins or sliders with 'ears' or red patches behind the eye tend to be red-eared sliders *Trachemys scripta elegans* or Cumberland sliders *Trachemys scripta troostii.* Cumberlands are rare and the ear is often pinkish or yellow-orange-to-red and often darkening from front to back. They have a dome-shaped shell that is dark greenish through to dark brown or black. Sometimes a pale stripe is present through each scute.

SLIDERS *'yellow-bellied type'*

The yellow-bellied slider *Trachemys scripta scripta* is closely related to the red-eared but with no red ear mark and you need to look for an S-shaped marking running from behind the eye down to the lower side of the neck. ***Remember S for Slider.*** When these intergrade with red-eared or Cumberland the red 'ear' is usually lost but you can get a colourless patch in that area. With practice you may be able to recognize 'pure' yellow-bellied with the help of a good picture for later verification. Sliders interbreed/hybridize with cooters (below) and you can get a cooter and slider combination of markings on these animals. They have a dome-shaped shell that is dark greenish through to dark brown or black. Often there is a pale stripe through each side scute. Sliders also have what can be described as yellow 'pyjamas' on their hind legs, much more so than cooters.

COOTERS *'cooter type'*

Only the river cooter *Pseudemys concinna* has a yellow line along the bottom side of the neck that forks around the back of the mouth, sometimes crossing the mouth. ***Remember C for river Cooter.*** It seems to be one of the terrapins most likely to be encountered and is able to survive a UK winter. Northern red-bellied cooter *Pseudemys rubriventris* and Florida red-bellied cooter *Pseudemys nelsoni* do not have this mark but may also be rarely encountered and have reddish markings on the shell. At a distance the markings of cooters and sliders and the various crosses are all but impossible to determine and sometimes the underside needs examination. If the red ear mark or the S-shaped marking is missing it is possibly a cooter of some kind. There can be a pale red stripe or reticulations on the upper shell.

MAP TURTLES *'map turtle type'*

Several species of smaller terrapin with a shell that angles from a central ridge like a shallow tent, sometimes with raised backward-pointing knobs and a serrated shell edge. Very large females lose the characteristic tent shape. Males show the body ridge character much more. The head can have yellow stripes with small rounded or other shaped yellow or whitish patches and lines.

OTHERS CATEGORY *'terrapin other species'*

There is a range of occasional and rarer sightings of other species with similar dome-shaped shells. These include diamondback terrapin *Malaclemys terrapin* with very pale or white legs with spots, European pond turtle *Emys orbicularis,* very dark shell with yellowish spots, Spanish terrapin *Mauremys leprosa.* The last two are similar to the sliders but generally smaller with much paler leg markings. Painted turtles *Chrysemys picta* are sometimes seen; these are often small with vivid red marks on their limbs and shell. Rarely snake-necked turtles *Chelodina* and *Macrochelodina* spp. and African helmeted turtles *Pelomedusa subrufa* are released and presumably survive into early winter. Once you have got to grips with the sliders, cooters and others described above and think it is not one of them, you may need to look at the traits of the other options below which are more aquatic and hardly ever seen, being more readily encountered through the use of basket trapping.

SNAPPING TURTLES *'snapping turtle type'*

Adults are massive bulky turtles but are generally timid and secretive. Much of the shell (upper carapace and lower plastron) is reduced compared with the sliders and cooters, and with large thick head, neck, limbs and tail. They have a large hooked upper beak. They do not often sunbathe and they tend to walk under water rather than swim.

MUSK AND MUD TURTLES

These are very small and hardly ever seen, at less than 120 mm in length. Species may include the common musk turtle or stinkpot *Sternotherus odoratus* and the razorback musk turtle *Sternotherus carinatus* and the eastern or common mud turtle *Kinosternon subrubrum.*

SOFTSHELLS *'softshell type'*

These are usually greenish or brown and with a flat rubbery looking carapace can be up to 50 cm in diameter. The nose is pointed and there are two prominent raised eyes. The most likely candidate for seeing in the wild is the eastern softshell *Apalone spinifer.* They are most likely to be seen in the very shallowest of water with their noses sticking out.

Figures 22 a–e have been prepared to assist those seeking to identify terrapins and turtles in the field at least to the taxonomic rank of genera. We have tried to show key diagnostic features, shapes and coloration and together with photographs should help observers gain a degree of accuracy. Identification can be tricky or impossible at long distance, and even on close examination terrapins are quite variable and can overlap in terms of size, pattern and colour. They are often coated in mud, and with algae on their shell. For identification purposes it is worth taking pictures from as many angles as you can, if possible including those from the front to show the head, side of neck, shell colour, pattern above and below the neck, and the underside (plastron).

Figures 22 a–e show types of freshwater terrapin/turtle recorded as abandoned in ponds, lakes and canals in the London Area, with typical silhouettes of body shape.

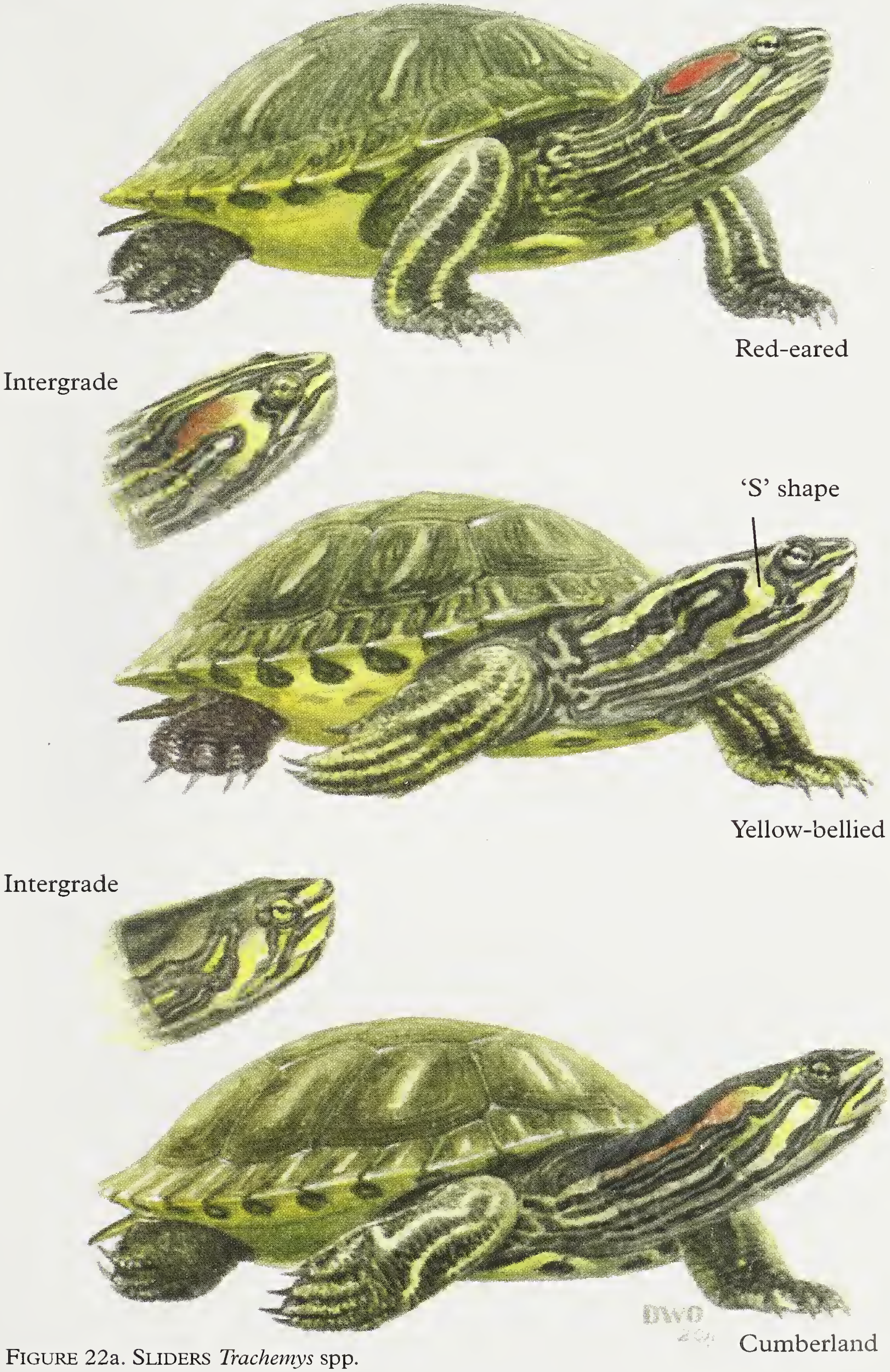
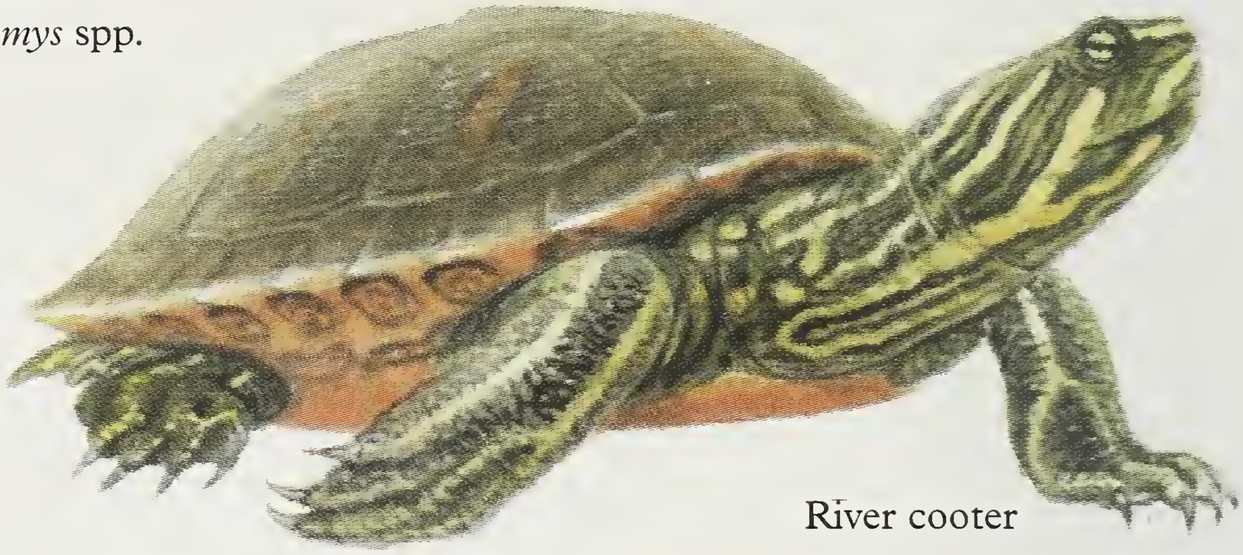


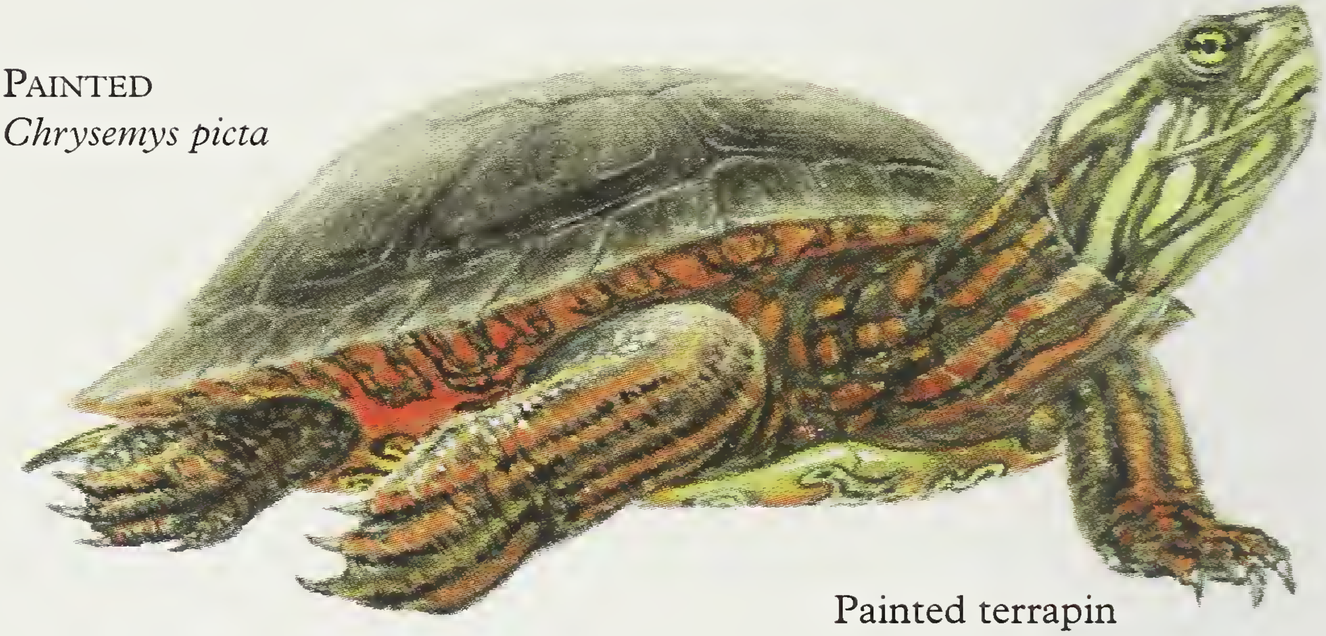
FIGURE 22a. SLIDERS *Trachemys* spp.

COOTERS
Pseudemys spp.



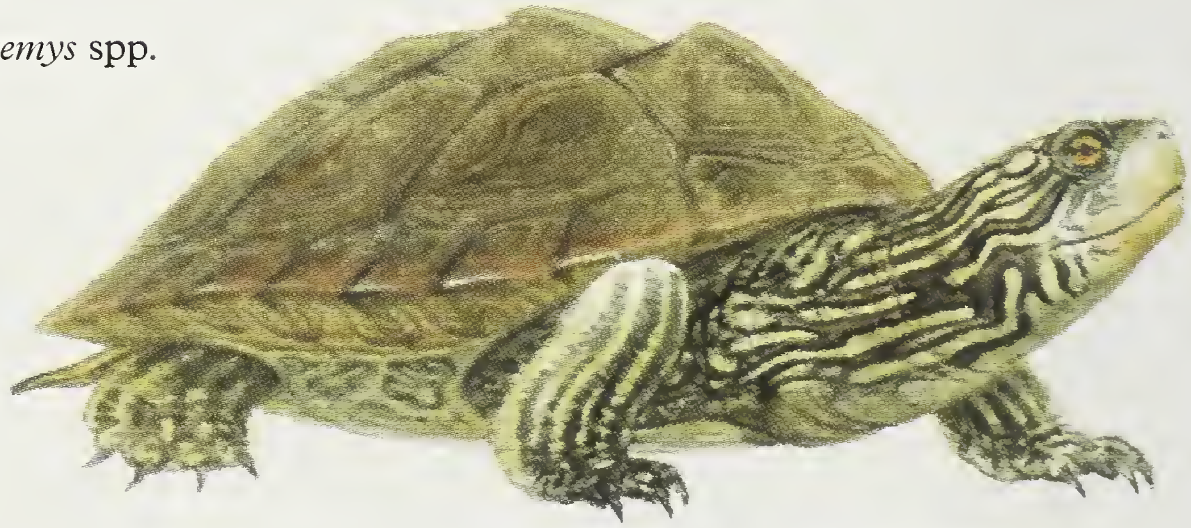
River cooter

PAINTED
Chrysemys picta



Painted terrapin

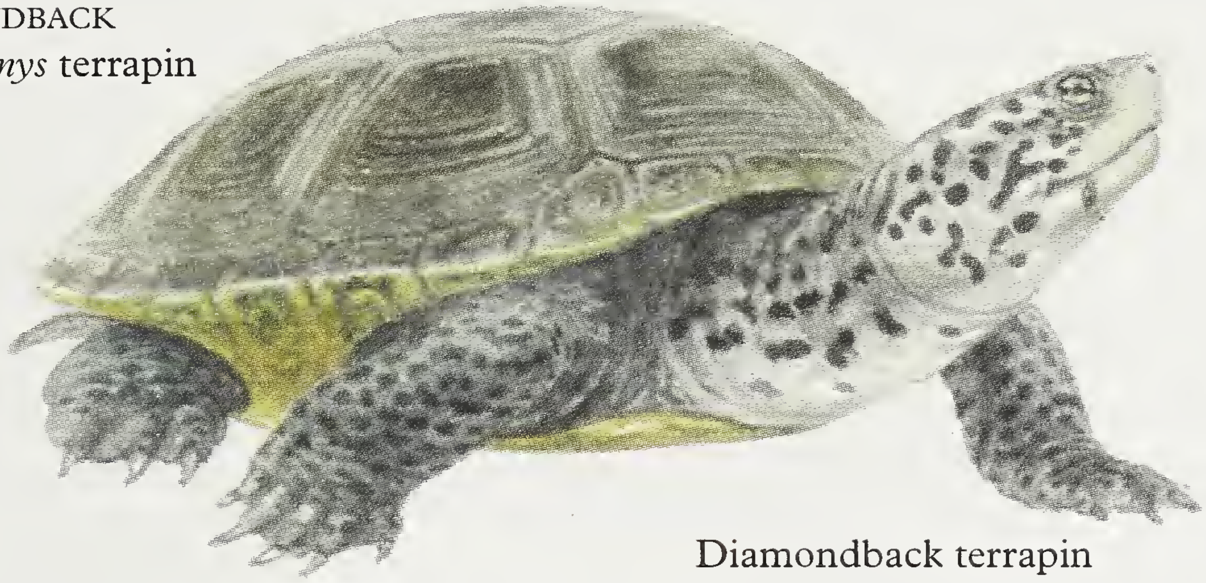
MAPS
Graptemys spp.



Map terrapin

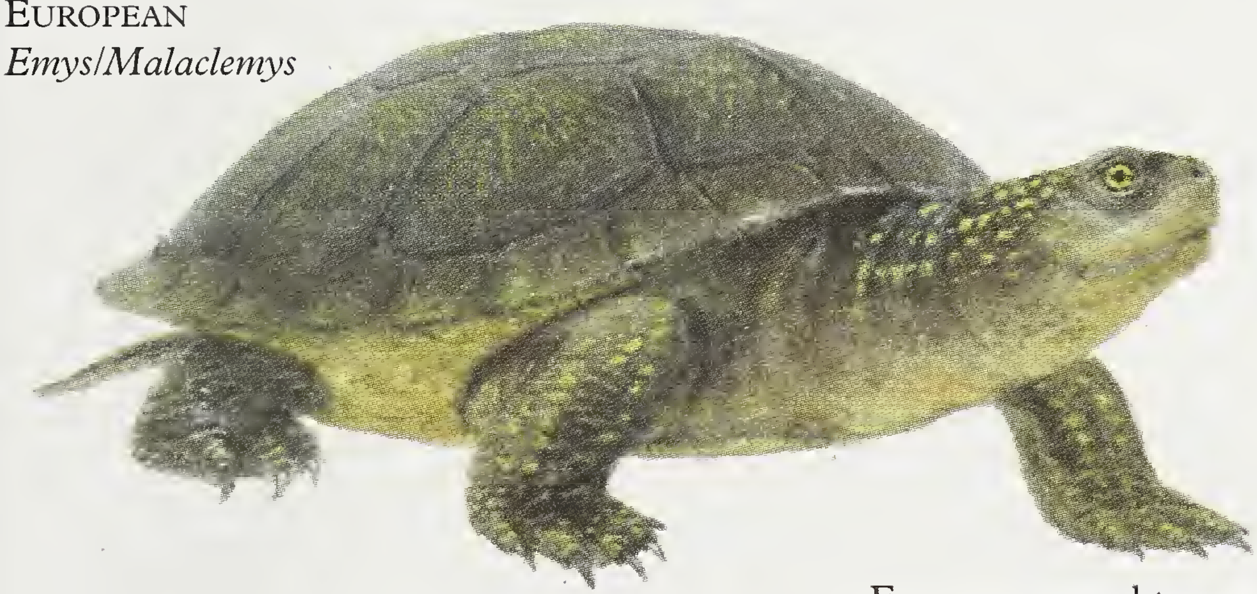
FIGURE 22b.

DIAMONDBACK
Malaclemys terrapin



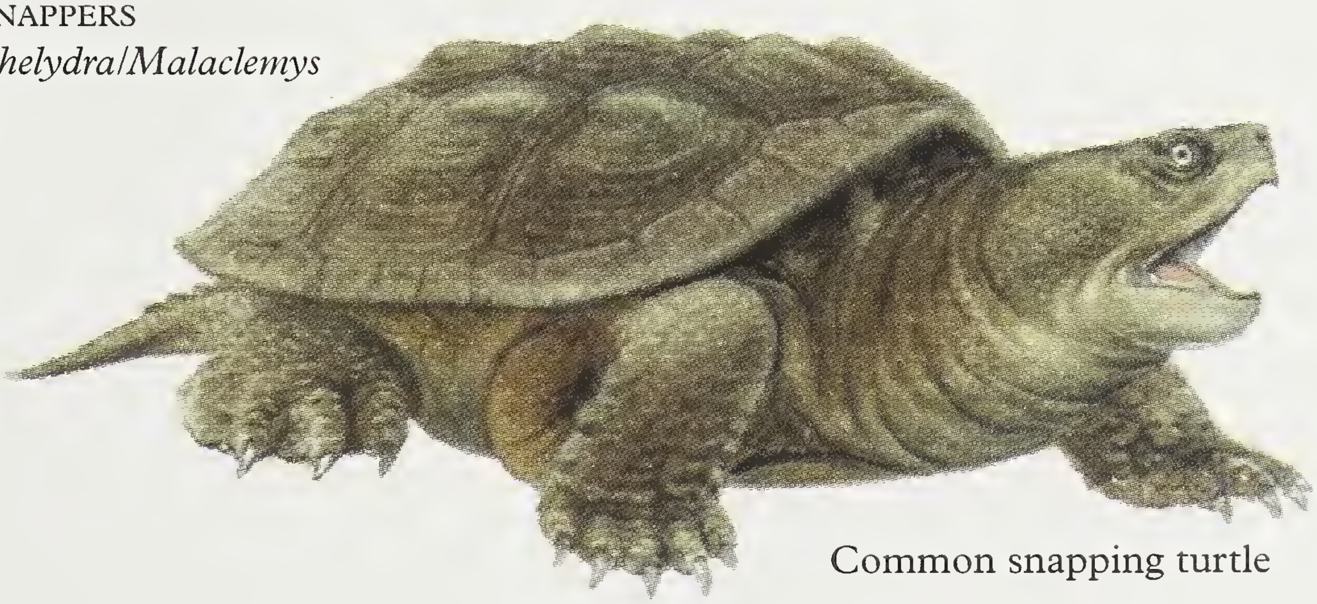
Diamondback terrapin

EUROPEAN
Emys/Malaclemys



European pond terrapin

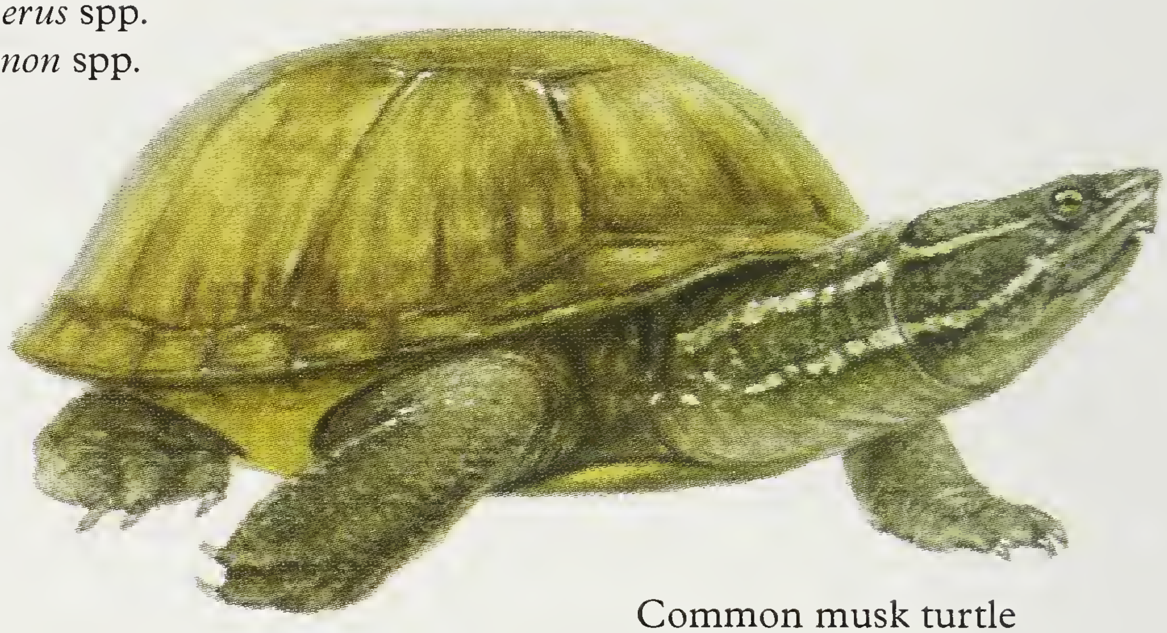
SNAPPERS
Chelydra/Malaclemys



Common snapping turtle

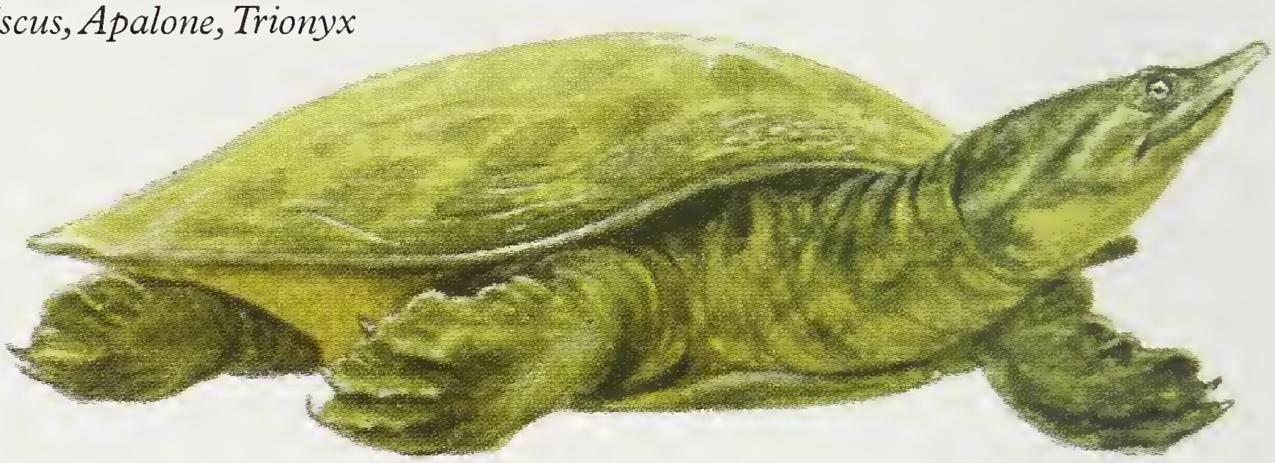
FIGURE 22c.

Musks/muds
Sternotherus spp.
Kinosternon spp.



Common musk turtle

Softshells
Pelodiscus, Apalone, Trionyx



Florida softshell

Figure 22d.

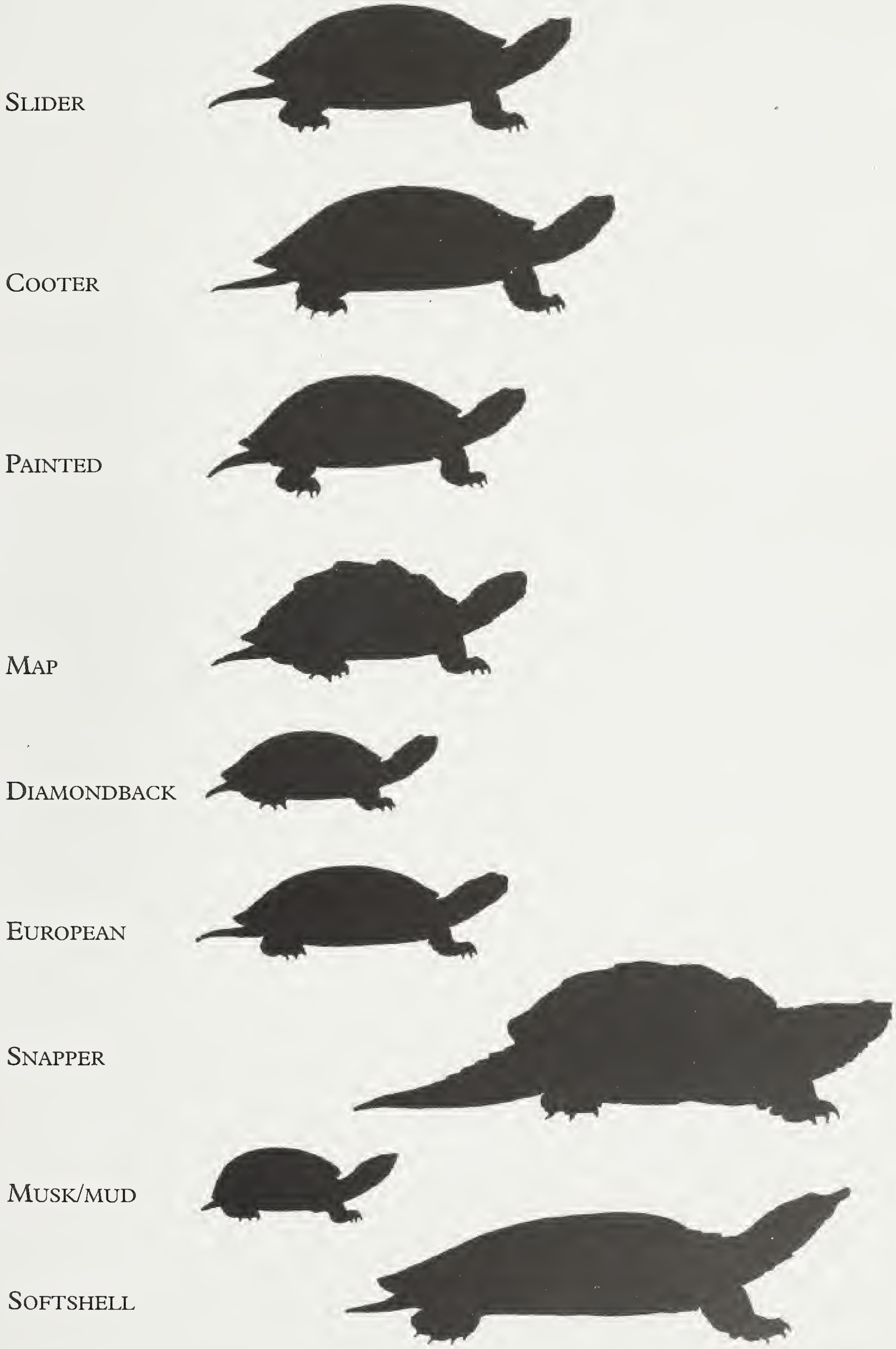

SLIDER
COOTER
PAINTED
MAP
DIAMONDBACK
EUROPEAN
SNAPPER
MUSK/MUD
SOFTSHELL

FIGURE 22e.

Species accounts — amphibians

Water Frogs *Rana* spp. (The genus *Pelophylax* has now become widely accepted)

The species/hybrids recorded or reported in the London Area, with their natural ranges are:

Levant green frog	*Rana bedriagae* Camerano 1882 (Turkey south to Egypt)
Iberian Water Frog	*Rana perezi* Seoane 1885 (Iberia, southern France)
Marsh frog	*Rana ridibunda* Pallas 1771 (east France to western China — may include other species)
Graf's hybrid frog	*Rana* kl. *grafi*, a cross of marsh frog and Iberian Water Frog
Italian pool frog	*Rana bergeri* Günther 1986 (Italy)
Pool frog	*Rana lessonae* Camerano 1882 (France, east to the Volga River)
Edible frog	*Rana* kl. *esculenta* (Linnaeus 1758) hybrid of pool and marsh frog.

Species/hybrids not recorded but possibly present include:

Greek/Balkan marsh frog	*Rana balcanica* (Albania and Greece)
Karpathos frog	*Rana cerigensis* Beerli, Hotz, Tunner, Heppich and Uzzell 1994 (Karpathos and Rhodos)
Cretan Water Frog	*Rana cretensis* Beerli, Hotz, Tunner, Heppich and Uzzell 1994 (Crete)
Epirus Water Frog	*Rana epeirotica* Schneider, Sofianidou, and Kyriakoupoulou-Slavounou 1984 (western Greece, south Albania)
Sahara frog	*Rana saharica* Boulenger in Hartert 1913 (North Africa)
Albanian Water Frog	*Rana shqiperica* Hotz, Uzzell, Tunner, and Heppich 1987 (southern former Yugoslavia area and Albania).
Italian edible frog	*Rana* kl. *hispanica* (Italy and Sicily)

There are other similar species from elsewhere in Asia that could also occur.

Problems with precise identification

Water Frogs are also collectively known as Green Frogs, while other generally more terrestrial, smaller and usually brownish coloured ranid frogs are often known collectively as Brown Frogs. We have used the term Water Frog here for reference to the more aquatic and larger Green Frogs that are all closely related. The taxonomy and consequent identification of different species of Water Frog is complex and more details on this with notes on other aspects of biology can be found in Appendix 2. These are the most common form of European frog and are all similar and closely related. They are arguably the most successful as they are active and capable of feeding in (and under) water as well as on land and the larger species can even predate smaller frogs. They are highly variable in pattern and colour. Most are widely distributed, other than in parts of northern Europe and with regional variations that are complicated by human transfers and hybridization. Until the early 1970s it was not widely realized that the edible frog was a hybrid of pool frog and marsh frog. Edible frogs are usually self-sterile but capable of reproducing with either parent species to produce more edible frogs. To complicate matters, some populations of edible frog appear to be self-sustaining, consisting of fertile hybrids. Because of these complexities researchers have often avoided their precise identification. In populations that may have up to three types present, their varied coloration and patterning also gives rise to confusion in identifying what taxa (species, subspecies and hybrid) are present in any given location and genetic tests may be needed to identify individuals. For these reasons, as with some of the interbreeding terrapins, this paper is more cautious than previous works on what exactly was/is present at each location and refers to 'types' rather than positive identification of exact species or hybrids. In a few cases previous identification from known origins along with details of characteristic body size and pattern may have been accurate but new information suggests much greater complexity now exists.

There are around twenty-five taxa of Water Frog in Europe. There have been considerable developments in the identification of them in Europe in recent decades following debate and recent detailed studies to try to separate them. Most distribution maps are incomplete because until recently pool and edible frogs were mostly recorded as one (Gasc et al. 1997). The pool frog occurs in mountain areas up to 1,000 metres in altitude but it is now very rare across its range as a single species. It is an ephemeral species unable to compete with marsh frog and its hybrid. The original separation of the species, as shown by Smith (1951) suggested that in northern Europe pool frog might be a more western European-originating species and marsh frog a more eastern European-originating species, both having met in the middle when redistributing into northern Europe after the last Ice Age and prior to the last major phase of sea level rise that cut Britain off from mainland Europe. The situation is still uncertain and it may be that the species were more sympatric and shared ranges (although pool frog occurs further west than marsh frog), but with greater niche partitioning before human disturbance increasingly promoted hybridization. The exact current distribution of edible frog is not fully established but molecular techniques should now allow closer examination.

Distribution and historical aspects

The distribution of Water Frog records in the London Area over the last 180 years is shown in Figure 23. There have been over 110 occupied 1-kilometre squares in the LNHS recording area and nearly sixty 1-kilometre squares with one or more Water Frog record in the recording hinterland.

There are approximately fifty documented releases or escapes of Water Frogs in the London Area and approaching eighty implied from individual records of isolated occurrence and many more are suspected. Records indicate four main core areas of Water Frog distribution, identified within clusters of one-kilometre square records with known or presumed breeding waters and associated wetlands. These are: the Heathrow/River Crane cluster, the Newdigate and Gatwick to South Nutfield cluster, the North Kent Marshes cluster and the Ockendon to Rainham cluster. In addition to these are seven smaller one-kilometre distribution groupings with between six and ten occupied one-kilometre squares and around thirty-four more isolated localities of up to three adjacent one-kilometre squares, representing one or more separate release(s)/escape(s). The date/s of first and subsequent records are indicated for many sites, as is the general direction of movement from natural spread or further transfer by humans since the first release or escape (Figure 24).

Although no detailed research appears to have been conducted, it is hard to see how the sale of live frogs for human food in wicker baskets in Europe has not occurred since at least Roman times. Importation of Water Frogs into Britain does not appear to have been researched in detail but the first known documented account is from the 1830s (Smith 1951). In terms of origin, there is a noticeable start to the recording of Water Frogs from the 1840s when there is frequent mention in published literature and good evidence of regular importation as well

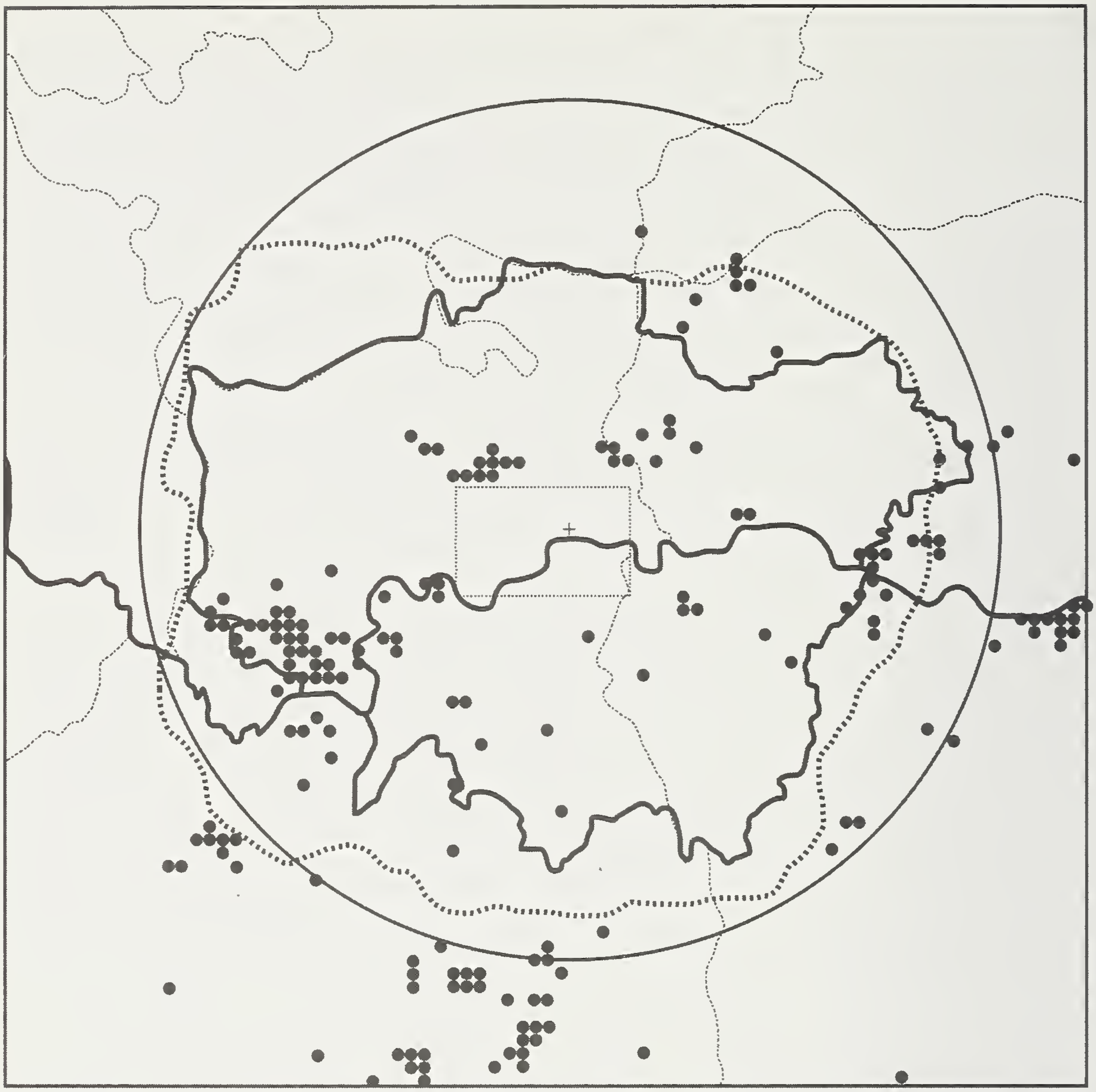


FIGURE 23. One-kilometre distribution records for Water Frog records in the London Area, 1830–2010.

as attempts to establish them. This period followed the end of difficult climatic conditions in northern Europe; the 'Little Ice Age' had ended. With warmer weather, a new era of importing plants and animals with better chance of survival outdoors must have seemed possible again to a nation that had experienced long periods of poor weather. In London, large water bodies were being increasingly engineered as public water supplies, such as the Brent Reservoir in the 1830s, and these will have attracted considerable public interest and new habitat for the release of animals. Water Frog release at Epping Forest is recorded in the 1840s and release or 'acclimatization' was increasing.

There is at least one London Area release in the 1870s with an unclear London location, but in general, after the well-recorded imports earlier in the century, records over the period 1850–1900 are few, possibly because the novelty value in releasing them had gone or perhaps because reporting them was less newsworthy. In 1900 and 1904 came the documented releases at Chilworth and Ockham in Surrey (Dalgleish 1904). Water Frog was recorded at Hampstead Heath in the period up to 1914 (see later) but it is not clear if they were derived from those present sixty years or so earlier or from subsequent release. Recorded releases also occurred at Ham Common and Ham gravel pits and at Teddington gravel pits

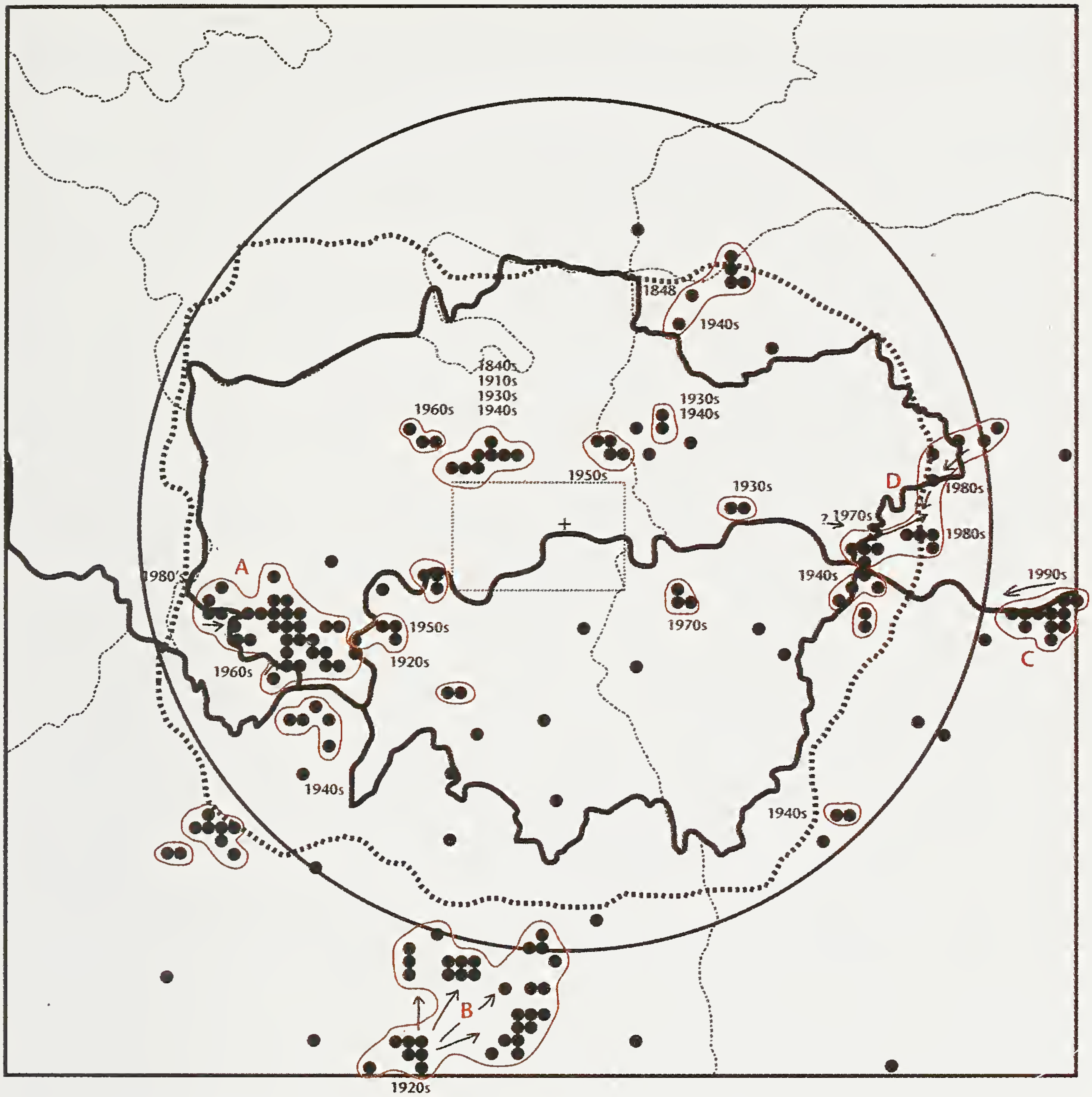


FIGURE 24. Location of main Water Frog clusters of occupation, sub-clusters and isolated locations as indicated by one-kilometre square occupation, with dates of first records and any perceived general direction of natural spread or transfer by humans since the first record of release or escape. Where: A is the Heathrow/River Crane cluster, B is the Newdigate and Gatwick to South Nutfield cluster, C is the North Kent Marshes cluster, and D is the Ockendon to Rainham cluster.

around 1929 (Fitter 1959). These were followed in 1937 by a release of marsh frog type at Barking Creek in east London. All these releases are reported to have been sourced from Romney Marsh in Kent. At Barking the release was apparently an attempt to bring biological control to mosquitoes by a local company (Fitter 1959).

The approximate number of recorded Water Frog releases/escapes that have been identified, starting from 1830 and over subsequent periods in the London Area are as follows: between 1830 and 1870 (8), between 1900 and 1940 (10), between 1940 and 1980 (28) and between 1980 and 2010 (31).

It is not clear if the apparent rate of increase is real or possibly a function of better communications in recent decades. The highest number is after the Wildlife and Countryside Act (1981) made it an offence (punishable by an unlimited fine or indeterminate prison sentence) to release non-native species into the UK, even if populations of the species are already present, suggesting that a lack of interest in enforcement has prevailed. These eighty or so release/escape events determined by this research suggest that on average over the last seventy years, Water Frogs have been/are released or escaping at a new location at a rate of around one per year, somewhere in the London Area.

Water Frog history in the London Area

The detection of fossil/sub-fossil evidence for Water Frogs in Britain since Roman times starts conveniently in London in the early 1980s with archaeological excavations at St Clare Street near Aldgate. This is the site of an old Roman cemetery that was positioned at the then edge of Roman London and about 600 metres from the River Thames. A rectangular pit, 1.3 square metres was found, thought to be around 2.5 metres deep when dug. It was excavated and the area dated at around AD 200. At its base, the pit had traces of the sides of a wooden container (0.75 metre square) with intact and broken pottery and within or amongst them a quantity of animal bones from 315 individual animals (Ellis 1985, Hibberd 1991). Barry Clarke, an experienced herpetologist at the Natural History Museum, helped identify the numerous amphibian bones that were mostly (n=232) those of common frog *Rana temporaria*, i.e., our native species belonging to the Brown Frog group of European frogs. A single Water Frog was identified from the group at the time as marsh frog *Rana ridibunda*. Some bones were also provisionally assigned to a single moor frog *Rana arvalis,* a species no longer present in Britain. The wide range of other animals — mice, voles, shrews, lizards, newts and even grey heron, suggested either a species-rich fauna was present, falling into a pit left open for a few weeks during spring, or a collection of animals placed there by adults for some kind of ritual purpose or by children playing. If of pitfall origin, it seems just possible that the heron tried to feed on trapped amphibians and also became trapped. However burial of collected animals seems more likely for a number of reasons including that the shrews and mice might otherwise have attacked and eaten each other and the amphibians resulting in bones that were incomplete or showing bite marks. Whatever the cause of deposition, it gives some evidence for placing a Water Frog at least at one location in London although the exact type was not determined.

Next, in the 1980s came the discovery of Water Frog bones amongst kitchen waste deposited in a medieval well in the garden of London Greyfriars, just two kilometres west of St Clare Street, dating to around the years 1480 to 1500 (Armitage and West 1985). As at St Clare Street a wide range of small wildlife species are present such as mice, voles, shrews and small birds. Kitchen waste included bones of cattle, sheep, pigs, chicken, fish and birds. Using frog pelvic (ilia) bones, this paper distinguished between common frog and Water Frog bones, assuming them to have been pitfall trapped in the well, rather than having been eaten and thrown away as kitchen waste. The identification to pool and edible frog however was made on the basis that this was the most likely Water Frog type to be present in England at the time (Barry Clarke, pers. comm.). Because head bones were not involved, in hindsight marsh frog cannot be ruled out.

However, all that can be currently gleaned from the St Clare and Greyfriars finds regarding Water Frog occurrence is that any combination of pool, edible or marsh frog (but also possibly others from further afield) could have been present in London in Roman times and around 1500, origin unclear, either native or introduced, like European rabbit *Oryctolagus cuniculus* as food. Finds of frog skulls or wet bones that could hold genetic traces are needed for better determination of species.

Thomas Pennant's *British Zoology* (1776) refers to both edible and common frog (as Linnaeus had before him) and in the context of them being eaten by humans although they were also used for dissection by anatomy classes. He refers to large numbers being on sale in baskets at Paris markets. Presumably by inclusion in the British fauna, their presence in the wild in Britain is implied but it is not apparently supported by reports from the local naturalists in London or

East Anglia of the time. George Shaw's *General Zoology* Vol. II lists 'Rana Esculenta' as 'the Green frog' and 'Rana Ridibunda' the 'Laughing frog' as two distinct species (Shaw 1802), the former with western Europe including England where it is 'rare', and the latter associated with Russia, although clearly by then well-established west of the Rhine. Like Pennant however, Shaw's account also does not tell us where they may have been observed. Further information on Water Frog translocation and status in the UK is given at Appendix 3.

Water Frogs and Hampstead Heath

Over the last hundred years, Hampstead Heath has provided an interesting reference on Water Frogs as it shows both the frequency of release and lack of persistence over a long period. The first record of one of the authors (TESL) at this location was made at the Viaduct Pond in 1967. The pond was in a rather treed and overgrown state, yet frog numbers were high enough to see and hear them jumping with loud splashes from the edge. The frogs, however, seemed to decline and were then no longer seen after a desilting operation in the mid 1970s.

Exactly when Water Frogs were first present at the Viaduct Pond is not known but they may have been there some time since its construction in the mid 1800s along with the older large ponds that must have rapidly increased amphibian numbers in the area. The location of an escape in the 1930s (Fitter 1949) is not clear but that they were present from 1940 is established. The Hampstead Scientific Society (1913) published an account of natural history of the Heath and this included a reference to 'Edible frogs' at a pond in the garden of Meadow Cottage at Parliament Hill, that had been recently levelled. Its position is close to the small pond that remains today in a private property close to Brookfield Mansions. Parliament Hill is a low spot that used to inundate rapidly in high rainfall. There is also an intriguing link in Henry Mayhew's detailed account of London in 1851 (Quennell 1984) when Mayhew interviewed two animal collectors selling on the streets of central London. Both referred to collecting frogs to sell for human consumption. Frogs were collected by at least one of them from the Hampstead and Highgate ponds areas and there are clearly two types and sizes:

> *'The snails and frogs I sell to Frenchmen. I don't know what part they eat of the frog, but I do know they buy them. The frogs is 6d and 1s per dozen. [presumably there is twice the meat on a Water Frog as a common frog] They like the yellow bellied ones, the others they're afraid is toads. I've had an order for as many as six dozen, but that was the French hotel in Leicester-square; but I have sold three dozen a week to one man, a Frenchman as keeps a cigar shop. Many people swallow young frogs they're reckoned very good things to clear the insides.'*

The yellow underside is a reference to common frog belly coloration that is usually yellow/yellow-orange in females although males are often whitish. This may have been a 'lay' check to avoid being sold toads although the larger 'edible' frogs were presumably easier to distinguish. Considerable French immigration to London around and after 1600 presumably established modern frog eating in London if it did not occur before, but for which there is little medieval evidence other than 'medicinal' use, although this is a valid area for student research. There are other accounts of 'French' people collecting frogs for 'the pot' in another urban area; Birmingham around the mid nineteenth century.

Water Frogs have also been recorded more or less continuously on Hampstead Heath from the 1930s to the 1970s where they last remained in the Viaduct Pond. In the 1950s/1960s the LNHS field excursions to Hampstead Heath were often specifically to hear and see the frogs in summer. The thought that they may have been present continuously for 130 years (1830s to 1970s) reflects the frequency of their release rather than their ability to persist. Richard Fitter's (1959) observation that no Water Frog population has survived more than a few decades, points to factors that suggest that up to at least the 1970s, the UK may have had factors preventing their colonization, including obviously inbreeding and inadequate climate for sufficient tadpole development. Today however, in places where habitat appears optimal and large scale, Water Frog populations seem to be robustly established and likely to persist.

Descriptions of Water Frogs in London by individual cluster:

The Heathrow/River Crane cluster

The origin of Water Frogs in the largest of the LNHS clusters is known to be multiple since the 1960s. The earliest source in this cluster was from the import of most probably a marsh frog type or Italian pool frog *Rana bergeri* or a hybrid, collected from Corsica during a holiday and established in a garden pond in Sunbury on Thames in 1964 by Alan Sauvarin of the Thames Valley Naturalists. These bred so well that he also kept them in tanks, only to find them swallowing each other, and observed an ability for one slightly larger to consume another. Alan told TESL that at first he used to search for them in his covered aquaria, not believing that this was possible. Froglets from his pond were however released nearby at Kempton where they spread into the reservoirs and other ponds in the vicinity and were soon moving into the racecourse and towards the Thames. They were however released too late to explain the origin of Water Frogs at Walton, Hersham and Molesley in 1961 just south of the Thames and a few kilometres away. In 1994 Alan Sauvarin found that domestic cat numbers were so high that they had killed off the entire adult population in his garden. Water Frogs located around that time at the Kempton Reservoirs appeared to be relatively small and of mixed appearance but were calling like marsh frogs (TESL, pers. obs. 1995), and it was suspected that possibly more than one type had been released in the area and interbred over the years.

The other major source in the general vicinity has been the Air Transport Cargo area of Heathrow Airport that sits in the south-west part of the Heathrow secured area and adjoining the Northumberland and Longford Rivers that drain into the River Crane. Notably, during 1988 and 1989, two shipments that were not packaged properly, each of around 1,500 Water Frogs (both probably being Levant Water Frogs *Rana bedriagae,* one from Egypt and one from Turkey), opened and released frogs into the inside of the aircraft. On releasing the external aircraft doors, many dozens if not hundreds of Water Frogs and probably other species, dropped onto the tarmac of the world's busiest airport and rapidly dispersed (Bob Quest, pers. comm.). More escaped from the boxes as they were unloaded and carried away. Many were rescued due to the proximity of the City of London Animal Reception (formerly Quarantine) Centre and the Heathrow office of the RSPCA. Those that were not killed or injured by aeroplanes or service traffic dispersed into the nearby watercourses and individuals that were found for a few days afterwards tended to be taken there by ground crew for release. Some of the frogs moved into the Perry Oaks Sewage Farm area to the west where they bred until the area was destroyed in the building of Terminal 5. Those recorded by King (1981) on the River Crane could have been earlier, similar but lower-scale escapes of a similar kind from incoming aircraft. It is also quite likely that Water Frogs were released elsewhere in the River Crane/Hounslow Heath area where they remain today. Spread has occurred for distances of around 7,000 metres in any direction from any known release point.

Hounslow Council became aware of Water Frogs following local residents complaining about the noise of males calling around the month of June along the Duke of Northumberland and Crane Rivers in the Twickenham and Whitton areas of Hounslow in the 1980s. Some welcomed and others hated the sound — reactions that echo those around Europe in places where they are native or introduced. During the 1984 London Pond Survey, TESL was surveying amphibians in one of the Hounslow Heath ponds with numerous Water Frogs around its edges and out of a hedge came a Council worker who had been hiding and watching for 'frog catchers'. In previous days, rescued Vietnamese refugee 'boat people' who were temporarily housed nearby had apparently ventured out. Seeing the large frogs and being subject to 'British' food they had set about catching them with sharpened bamboos borrowed from an allotment. The previous day, one batch of frogs had been observed being carried away, impaled on a stick and the authorities had been alerted. Doug Napier, then working at Hounslow Council subsequently took on the job of researching Water Frog distribution in the area and extended it more recently into a dissertation (Napier 2006) further adding to the many records for this area.

The Newdigate and Gatwick to South Nutfield cluster

Despite the Water Frog releases elsewhere in Surrey at the time, what is thought to be the main source of the current Water Frog community within the Newdigate area began to develop at Beam Brook Nurseries at some point after it started in 1903. Here there were small animal-holding enclosures including a range of ponds that became increasingly open to escape at some point before 1940 but possibly from an early point following its establishment. Escapes and releases were the result of the international animal import businesses with interests there, including Gerrard and Haig and Griffin and George (Medical Research Council 1968). The 'melting pot' of Water Frog types was topped up with a wide variety (amongst several other non-native herp species) until large-scale trading ceased around the late 1960s but probably also after that date by incidental releases of small numbers. Amphibians were collected in low numbers for sale until at least the late 1990s and several colonies of Water Frog have been established elsewhere as a result. Recent reinforcement of Water Frog has occurred as a result of their numbers growing in the large adjoining Newdigate brickpits, abandoned in the 1970s/80s and where numbers were high in the 1990s and they can be found today (TESL, pers. obs.). Julia Wycherley identified five different types in the mid 2000s: *Rana bergeri, Rana* kl. *esculenta, Rana lessonae, Rana perezi* and *Rana ridibunda* (Wycherley 2003*a, b*) based upon analysis of male advertisement call patterns and genetic (RAPD) analysis.

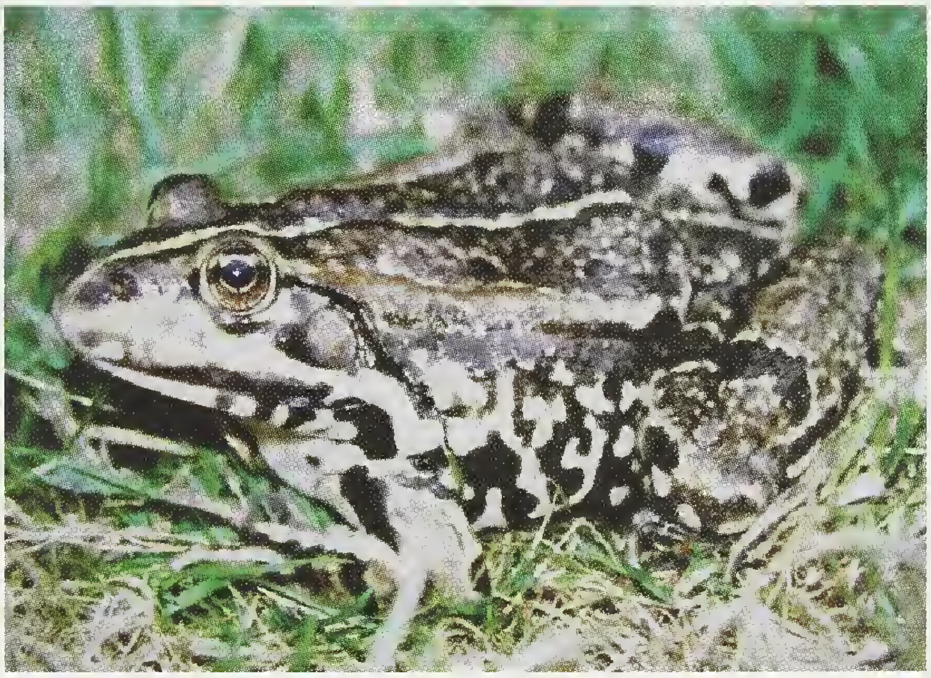


FIGURE 25. Edible frog type from the Nutfield area. *Photo: Will Atkins*

Local ponds appear to have been colonized through frog dispersal along the Beam Brook stream, but it was in a period following the hot summers of the late 1980s, around the period 1990–1994, that dispersal appeared to be increasing, with records found further afield from the Beam Brook source (TESL, pers. obs.,

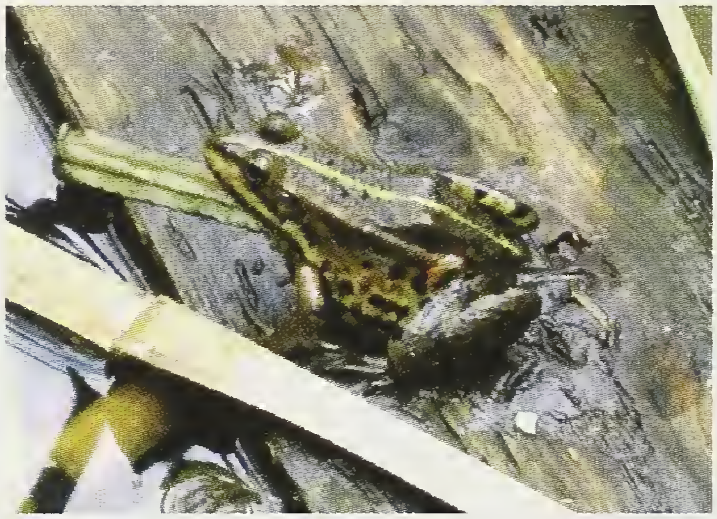


FIGURE 26. Edible frog type at Marbles Pond, Burgh Heath, Surrey. Described as one of the darkest colour variations encountered — mainly dark brown with a bright green vertebral stripe. *Photo: Doug Napier*

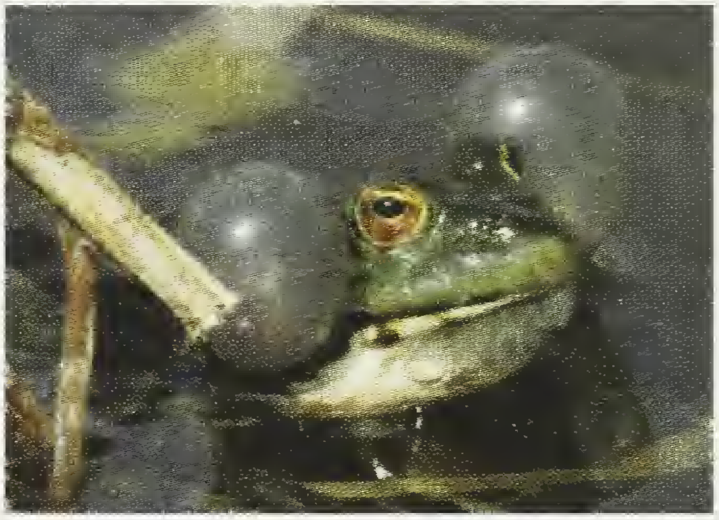


FIGURE 27. Male marsh frog type calling at RSPB Rainham Marshes. *Photo: Mark Webb*

Joslin and Wycherley 1994). A second source had been deliberately established at and around South Nutfield, centred on the Xenopus Ltd Biological Suppliers site which was founded from Newdigate animals. The Water Frog distribution is fragmented in this cluster and spread is likely to have been mediated by human transfer as well as natural dispersal along rivers. The Gatwick area distribution may well be from a human release/s in the 1980s. Maximum possible natural dispersal in this cluster has not been shown to exceed ten kilometres in any one direction although movements along the River Wey and associated canals and the Upper Mole, could in theory have allowed their movement for further distances, but this has not been demonstrated.

The North Kent Marshes cluster

Marsh frogs *Rana ridibunda* from Hungary were introduced to Walland Marsh in Kent in 1935, via the well-recorded garden releases/escapes of E. P. Smith. The female marsh frog is capable of growing up to around 180 mm maximum snout–vent length (some books suggest 200 mm can be achieved) compared with the pool and edible frogs that reach up to around 90–120 mm. Hence marsh frog is by far the largest and most dominant Water Frog type.

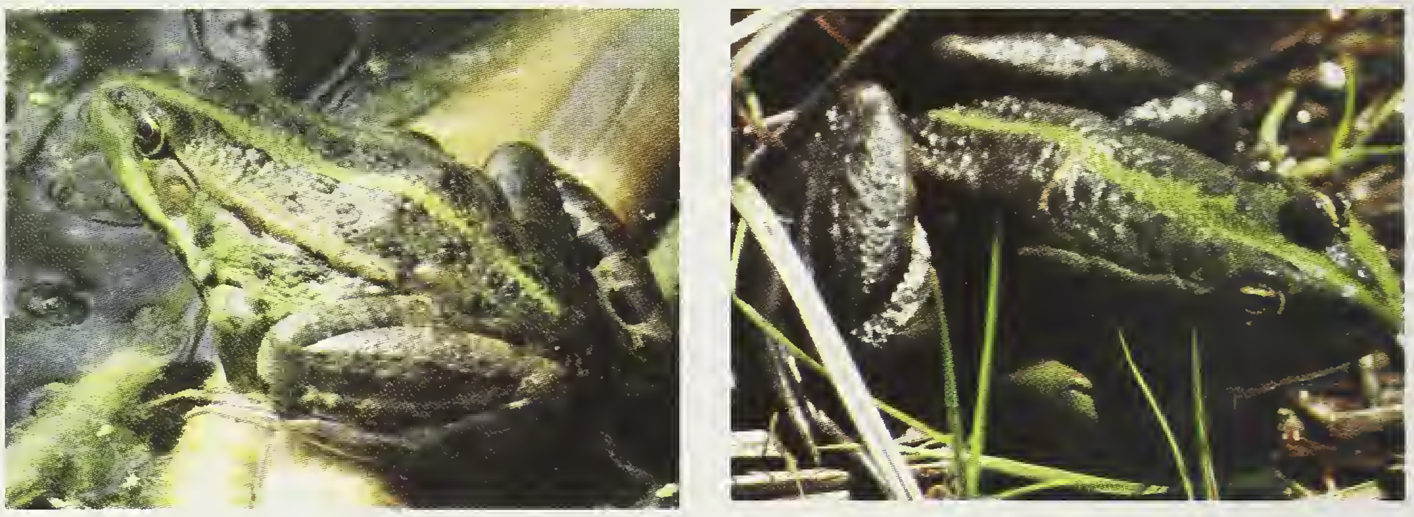
On the south Kent coast by 1940 the release had spread to occupy over 50 sq. km and by 1950 around 150 sq. km (Philp 1998). By the early 1970s there were records from the North Kent Marshes at Sittingbourne and Sheppey, apparently moved there from the Walland/Romney area by birdwatchers (E. G. Philp, pers. comm. to TESL) on the basis of them being 'good food' for birds. They were also transferred by humans west to Lewes Brooks in Sussex. The marsh frog is established widely over central south Kent and has spread in a linear fashion along the River East Stour and the River Great Stour between Ashford and Canterbury. Again movement may have been assisted by human transfers.

From the 1980s there has been gradual spread across Sheppey, and westwards close into Gravesend in more recent years, with considerable numbers recorded on marshland located between Higham Bight and Gravesend. There is some suspicion that other Water Frog types have mixed in with them, possibly from the south Essex coast animals (see below). The block of urbanization at Gravesend seems to stop the westwards advance on the south side of the river. There are older (1950s) records of long-extinct Water Frog releases in the Dartford Creek and marshes area. These have been added to recently with records from west of Littlebrook Power Station. These could have originated from frogs crossing where the Mar Dyke enters the Thames and the crossing distance is only 600 metres or so or possibly those moving or carried along the Thames from the east.

The Ockendon to Rainham cluster

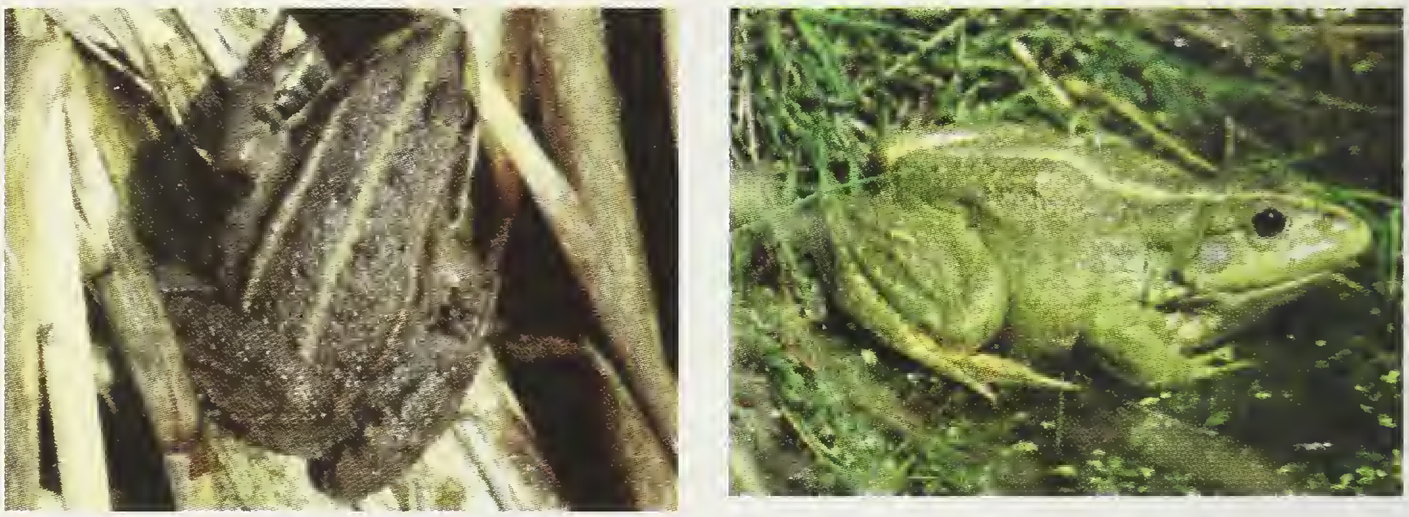
The origin of Water Frogs along the Essex coast has been described for us by Ray Cranfield who has been active in the area with his son Jon for many years now. Apparently they were first released a little way beyond our study area, behind the railway station by the coast at Old Leigh-on-Sea in the early to mid 1970s. The Hadleigh population (it is believed) was introduced into the borrow dykes behind the golf driving range at Leigh in the 1990s by a local person who collected tadpoles from Camber Sands in Kent. By the end of that decade the marsh frog type frogs had moved along the borrow dyke to Benfleet and dispersed into the drainage ditches of the Hadleigh and Benfleet Downs. The population has spread northwards towards Hadleigh and they are now found in fishing lakes (Colony Lakes) quite close to the car park of Hadleigh Country Park. On release they are reported to have rapidly moved west into what is now Hadleigh Marshes and Hadleigh Castle Country Park near Benfleet, occupying quite an extensive area. Water Frog tadpoles taken from the Hadleigh area were then moved into London by East End enthusiasts; one known batch was raised in a Dagenham garden. Although not documented, the Water Frogs at Dagenham that were present in the 1980s (TESL, pers. obs. 1984) are probably derived from this or another garden escape or releases in the local area around the late 1970s. Releases were also made subsequently, possibly during the early 1990s at Davy Down in South Ockendon where they were recorded in 2004. Tadpoles were collected from another Essex Country Park (location unknown, probably Hadleigh Country Park) and a South Ockenden resident decided to release the frogs across lakes and ponds located in the Mar Dyke catchment, although multiple sources of colonization of that water body from local fish farm/pet-keeping sources are possible and even quite likely. The Mar Dyke is fed by tributaries that extend to the west of Basildon near Horndon at the edge of the LNHS area. Other Water Frogs (type unknown) are reported to have been released around South Ockendon more recently. The spread of the marsh frog from South Ockendon downstream to Rainham seems likely where they may have met with the slightly older eastwards spreading Water Frog population there in the 1990s and also up to fishing lakes near the A127. They are also present further east along the coast. Marsh frog juveniles are still sold in pet shops in Essex (being sold in 2009 and 2010) in Rayleigh near Leigh-on-Sea (also in the Colchester area), despite their unsuitability as house pets and likelihood of breeding and escape when put in garden ponds.

Water Frog has extended into what is now the RSPB reserve at Rainham Marshes and the timing suggests the Mar Dyke source may have been the main one there. Howard Vaughan has been birding there since the mid 1980s and does not remember any arriving from Dagenham before then, although a combination from both areas is possible. Water Frogs that show characteristics of marsh frog *Rana ridibunda* but also that look like other Water Frog species/hybrids are now prolific across the site and can be found in every ditch, west up to the edge of the silt lagoons. They have apparently never been heard on 'the silts' or in the ditch system at the far west end of Rainham Marshes South. The Rainham frogs are highly variable in size and pattern with colours ranging from turquoise blue through baize green, to dark chocolate brown and including individuals reported to look like xanthistic specimens with yellow skin and red eyes (Figure 28, a–m). Many are plain looking but a percentage has a pale green lateral dorsal stripe while others are very blotchy in appearance. There are a number of large dominant adult female individuals at Rainham, reported sometimes to sit very upright, possibly watching for prey or competitors.



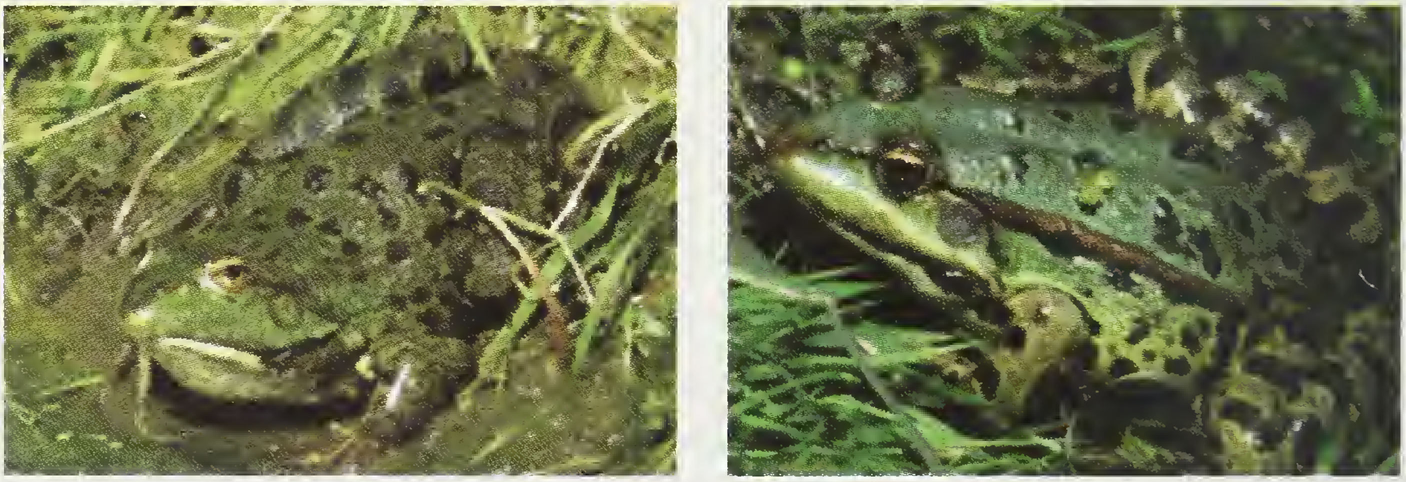
a) Green/gold with green stripe, dark blotches and banded/blotches legs.

b) Brown with green stripe and with few clear markings.



c) Brown with pale stripe and low density dark brown blotches.

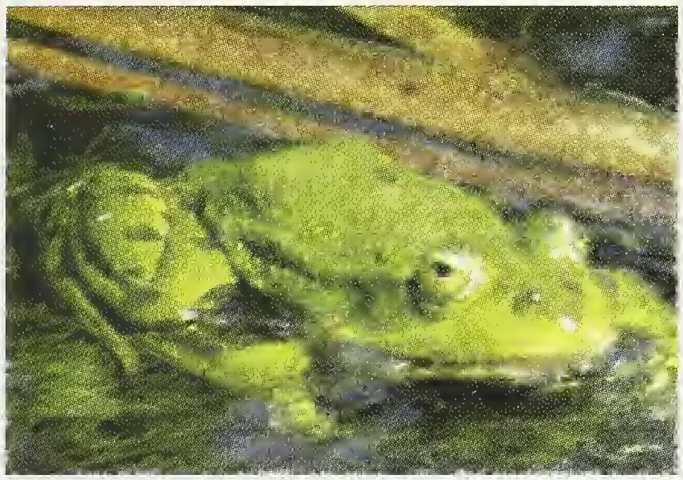
d) Pale green with yellow-green stripe.



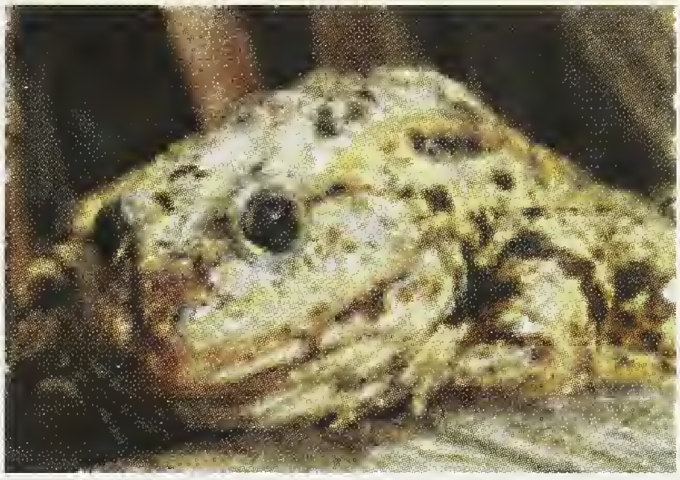
e) Variable olive green with dark brown blotches and banded/blotched legs.

f) Turquoise with dark brown blotches and banded legs.

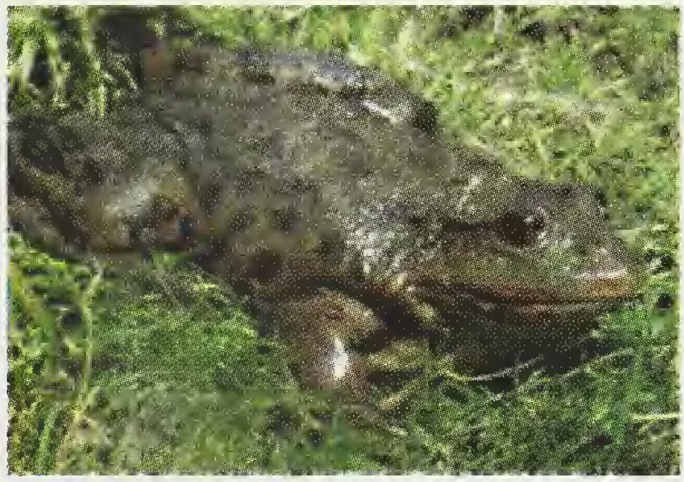
FIGURE 28, a–m. Water Frog pattern and colour variability from RSPB Rainham Marshes.



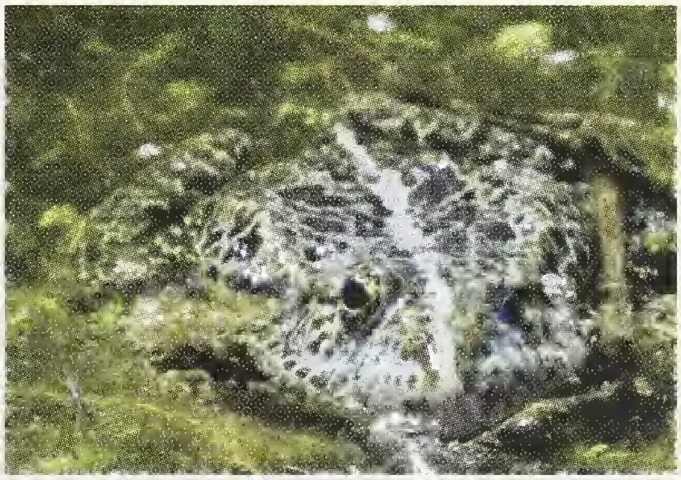
g) Green with few mid-green blotches.



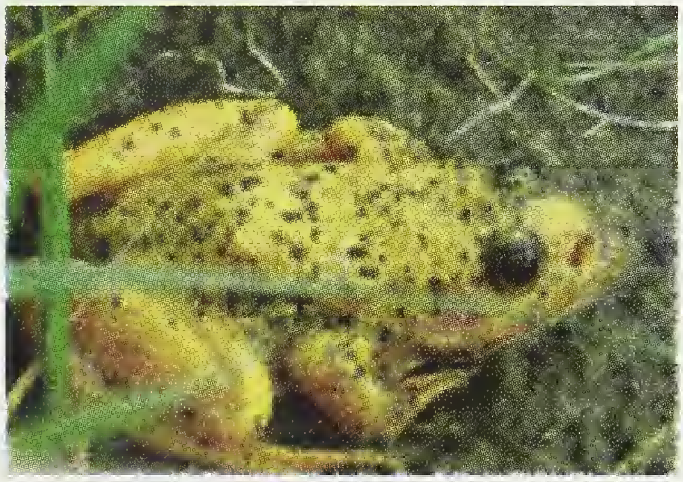
h) Beige/off-white with brown freckles and blotches.



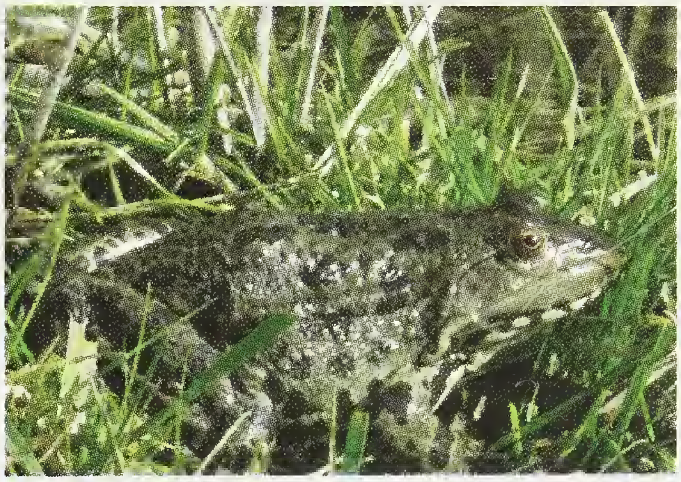
i) Pale brown with green blotches.



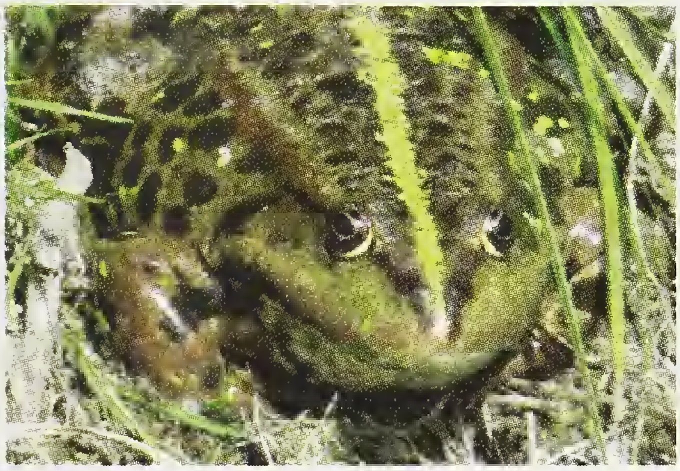
j) Light blue with blue stripe and dark olive-brown variable markings.



k) Yellow with variable brown dot-like markings.



l) Olive grey-green with dark olive-grey markings.



m) Olive-green with bright green stripe and dark brown markings.

Photos: Howard Vaughan, Mike Hughes, Daniel Woollard, Pete Merchant, Freddie Roll, Roman Muryn and Anon.

The past and present distribution of Water Frogs in London as illustrated in Figure 23 indicates that perhaps not surprisingly, in urban and city edge habitats their colonization and survival is not that secure. The distribution is limited, not just because they are at the edge of their climatic range but because habitats are relatively small and fragmented and the frogs suffer the same isolation pressures as other native wildlife. Inbreeding is likely to be a factor with initially small founder numbers. The Rainham population looks to be expansive and the north Kent area to the south-east also appears quite robust. It is clear however that many if not most Water Frog populations in the past have lasted under thirty years and often less. The three smaller north London Water Frog sub-clusters at and around Epping, Hampstead Heath and Walthamstow have survived for some time but seem limited in terms of future dispersal due to their urban surrounds and low density of suitable breeding ponds. They seem likely not to last that long under current circumstances even with a degree of restocking from local garden populations. Equally, in the Surrey countryside, with limited pond conservation work being undertaken, it will be interesting to see if Water Frog distribution consolidates or depletes over the next few decades. Certainly Doug Napier's field research suggests that occupied sites can relatively quickly lose their Water Frogs.

Other European amphibians

European green tree frog *Hyla arborea* (Figure 29)
11 records inside, 2 records outside LNHS area.

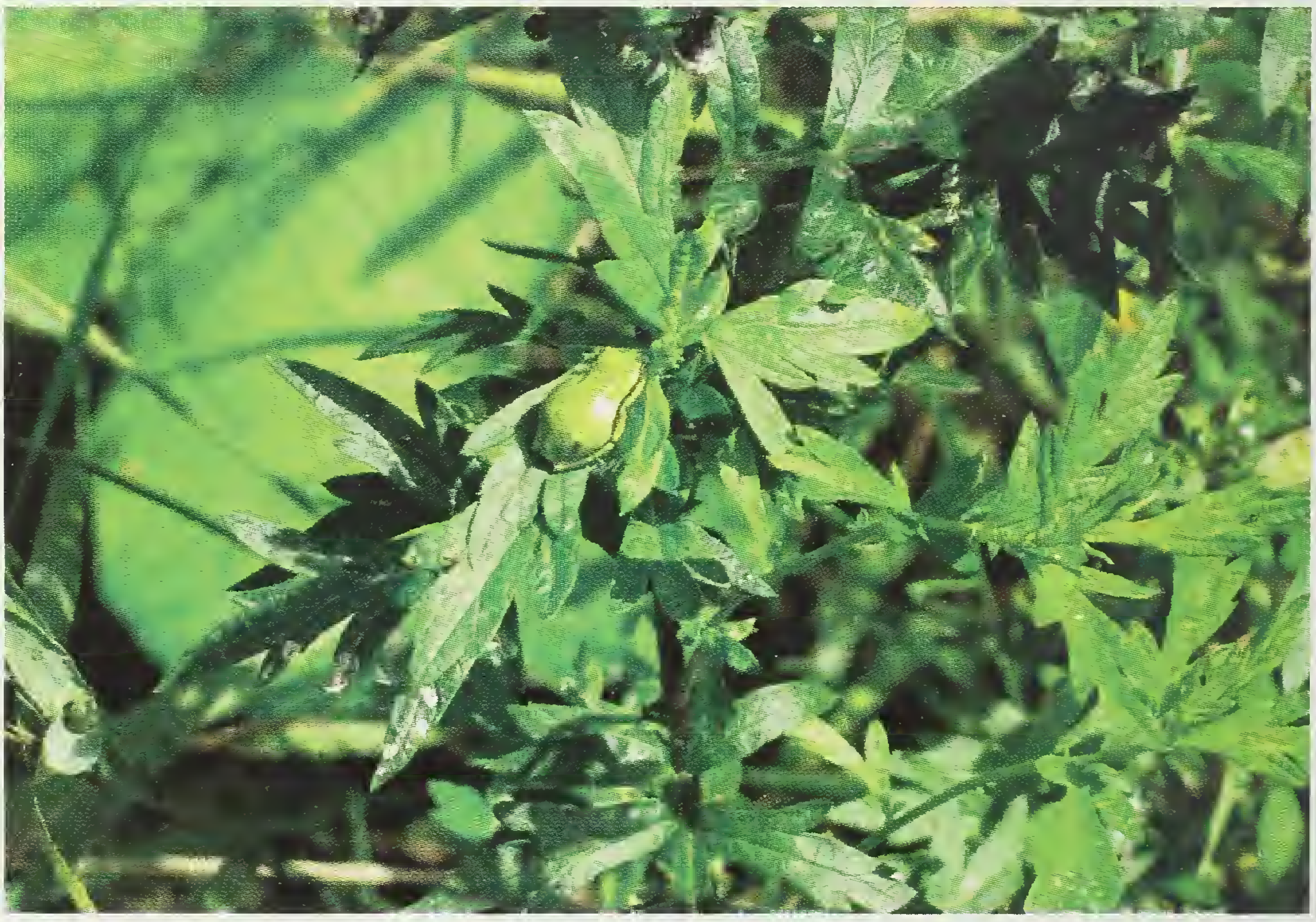


Figure 29. Juvenile tree frog basking on leaf. *Photo: Tom Langton*

Tree frogs have been a common trade species in the past, many have escaped or been released but few have established breeding colonies. Inside the LNHS area one small maintained colony at the Birdbrook/Kidbrooke sites has held on in small numbers. The colony has apparently both been collected from and topped up since its origination from the garden of Charles Snell, after breeding there in

1980 (Snell 1981). Outside the LNHS area, tree frog breeding has been reported in Essex from specimens reported to be of Turkish origin. These bred in the garden of Antony Millwood in Basildon with a range of other amphibians and could even be a different species. Tree frog clearly struggles to survive outdoors, no doubt as with other species due to thermal limitation in tadpole development as well as lack of suitable habitat. Colonies are kept around the UK in sunny garden ponds and one colony in a secluded pond in the New Forest appeared to have hung on for more than a few years before being collected by dealers or hobbyists. Outside the London Area numerous attempts have been made to introduce this species since the 1840s and all have failed (Lever 2009). Although the species was probably present with the European pond terrapin after the last Ice Age there is no evidence of its survival after the main period of climate deterioration. Modern understanding of distribution shows its current range to be further south and east in Continental Europe. Another species, *Hyla meridionalis,* is also likely to have been released occasionally in the past.

PARSLEY FROG *Pelodytes punctatus* and PAINTED FROG *Discoglussus pictus*

Two parsley frogs were seen at Birdbrook (Birdbrook Nature Reserve) in 1993 and a single adult female painted frog was found at Oak Hill Farm Pond, Epping Forest in 1999 by WA and CH. There is no evidence of breeding and these are likely to be escaped/released pets.

MIDWIFE TOAD *Alytes obstetricans*

12 records inside, 5 records outside LNHS area.

Introduced to Bedford in the late-Victorian period, midwife toad is widespread in mainland Europe. Although populations have bred and persisted locally in the UK for several generations, other than in Bedford there has been no extensive colonization from source areas. There are a number of records from the Epping Forest area by the Essex Field Club but these do not appear to have resulted in populations forming or spreading. There has been a newer urban population with males calling, breeding and dispersing at least to adjoining gardens (1992–1996) in Wandsworth but its current status is not known. Outside the LNHS boundary, midwife toad has been reported in three small colonies in High Wycombe since 2006 and possibly before then, and there are rumours of an older population in that area. They have been present on National Trust property in Ashridge, Buckinghamshire where they may now no longer be present as a pond has been removed, but they had been there from 1970 until quite recently (NT Website). These five older locations were not reported in Lever (2009).

YELLOW-BELLIED TOAD *Bombina variegata* and FIRE-BELLIED TOAD *Bombina bombina*

Yellow-bellied toad *Bombina variegata* were reported to be introduced after 1977 and to be breeding at Birdbrook Road in the 1970s. There are not surprisingly scattered records in gardens and other urban water bodies of this widely traded species but no sign of significant establishment and persistence. The fire-bellied toad *Bombina bombina* apparently achieved breeding status at Beam Brook Nursery but failed to establish elsewhere despite several attempts to move it. A more recent introduction of fire-bellied toad from Turkey has apparently established in the Kingswood area of Basildon (Ray Cranfield, pers. comm.). Everything points to conditions in the UK being borderline for its survival. It does occur at more northerly latitudes in countries where summers are hotter.

Urodeles: newts and salamanders

Alpine newt	*Triturus alpestris* [*Mesotriton alpestris*/ *Ichthyosaura alpestris*]
Alpine/smooth newt hybrids	*Triturus alpestris* × *vulgaris* hybrid
Southern banded newt	*Ommatotriton vittatus*
Marbled newt	*Triturus marmoratus*
Italian crested newt	*Triturus carnifex*
Crested newt hybrids	*Triturus carnifex*/*cristatus*/*dobrogicus* hybrids

ALPINE NEWT *Triturus alpestris* [*Mesotriton alpestris*/ *Ichthyosaura alpestris*]

Within Greater London, Alpine newt breeds at the Birdbrook/Kidbrooke sites and in a garden pond in Beckenham. Just outside the LNHS Area, the Beam Brook Nurseries site is thought to have had alpine newts present and breeding for many decades and individuals from there were taken for release at the Xenopus Ltd site in South Nutfield in the 1980s and survived for a few years. Alpine/smooth newt hybrids have been reported from Beam Brook Nurseries in the 1980s (Gillett 1988).

The Essex Amphibian and Reptile Group report finding alpine newt populations in garden ponds at Rochford, Southend and Basildon where in addition they were present at Willow Park, an Essex Wildlife Trust nature reserve, in 2002. They were released on Chorleywood Common in Hertfordshire around 1970 and have remained there in several ponds after forty years. They have been sustained in the wild near to another urban area; Edinburgh, at Golden Acre Quarry where TESL was brought in to check what had been described as a great crested newt *Triturus cristatus* pond, to identify alpine newt instead, as tadpoles had been previously misidentified. The pond had received protection and a road had been moved to avoid a pond held within a stone quarry. Alpine newt had been released by a genetics researcher at Edinburgh University in the late 1950s when they were surplus to experimental use. This species has been recently identified as a carrier of chytrid fungus in Britain. The DEFRA non-native species secretariat web pages indicate the pathogen has been identified together with this species in a number of locations.

SOUTHERN BANDED NEWT *Triturus vittatus* [*Ommatotriton vittatus*]

One record only exists for a dead adult at the Kidbrooke site, located in 1997.

MARBLED NEWT *Triturus marmoratus*

Inside the LNHS boundary there are a few records from Birdbrook NR and an adjoining garden pond. Outside they are reported at Beam Brook Nurseries but breeding records do not seem to have been confirmed at any site although this seems quite possible.

ITALIAN CRESTED NEWT *Triturus carnifex* and *Triturus cristatus* group *carnifex*/*cristatus*/*dobrogicus* intergrades/hybrids

There are four morphotypes of the crested newt superspecies where previously subspecies of *Triturus cristatus cristatus* have been described.

Inside the LNHS area, *T. carnifex* was established for around five years at the Xenopus Ltd site at South Nutfield and there are other small isolated mainly garden sites elsewhere in the UK. Outside the LNHS area, the release of non-native members of the *cristatus* group has resulted in hybrids being found at Beam Brook Nurseries in Surrey where all four types are likely to have been mixed. Initial considerations were that the main crosses were *cristatus* × *carnifex* but *cristatus* × *dobrogicus* and *carnifex* × *dobrogicus* was also considered possible from the 'look' of a few of the animals. However, as with Water Frogs, these closely related species may have resulted in animals with mixed genes in previously undescribed ratios. In 1998 the ecological consultancy HCI Ltd funded research into morphological variation at the site (Brede et al. 2000). With police involvement to halt trade that was found to be ongoing, an evaluation of the extent of hybridization in the surrounding countryside was conducted. The study concluded little sign of spread of non-native characters in surrounding populations and that local GCN appeared to be dominant and possibly resistant to replacement by hybrids which was fortunate. However, genetic studies would be useful to see if the local native species surrounding the site remain completely unmodified.

Non-European amphibians

AFRICAN CLAWED FROG *Xenopus laevis*

Sometimes also called African clawed toad, this is an aquatic species up to 150 mm. From the 1930s it was used in human pregnancy testing and biology teaching. This and other similar species from sub-Saharan Africa also entered the pet trade from the 1960s. Inside the LNHS recording area the species was apparently breeding at and around the Xenopus Ltd site in South Nutfield in the 1980s. Elsewhere it has appeared as breeding in the wild in England and Wales, but it does not appear to spread to any great extent from points of establishment although it may be under-recorded. Located in 2003 with American bullfrog at the site near Edenbridge in Kent, a cohort of tadpoles were thought to have been fully eradicated with use of pond draining, netting and rotenone treatment, but a few adults were caught afterwards and checking continues. The origin there was linked to a biological supply company nearby that bred *Xenopus* for sale around the UK. The Nature Conservancy Council funded trials some time ago that suggested that *Xenopus laevis*, in small containers in captivity will predate native amphibian species larvae but did not seem to prey on sticklebacks *Gasterosteus* sp. that were offered (Tinsley and Simmonds 1987).

Xenopus laevis has been linked to the sudden appearance of the fungal disease chytridiomycosis, the cause of reported amphibian deaths and population declines in several continents in recent decades. One theory is that the amphibian chytrid *Batrachochytrium dendrobatidis* was introduced from Africa in this species around the world (Weldon et al. 2004). In this study, around 700 preserved specimens of three species of *Xenopus* were examined, these having been collected from 1879 to 1999 in southern Africa. Toe webbing was examined for signs of disease. Chytridiomycosis was found in a *Xenopus laevis* frog from 1938, and the overall prevalence was about three per cent of specimens examined. However, despite very strong circumstantial evidence, the origin, exact nature and cause of recent outbreaks remains largely unclear. Chytridiomycosis was an endemic infection in southern Africa for twenty-three years before being found in other continents. Possible spread of the disease around the UK is considered in the disease section (see later). Oddly, we have had no records of the axolotl *Ambystoma mexicanum* in the wild, despite it similarly being commonly kept in schools and as domestic pets for at least two decades.

AMERICAN BULLFROG *Rana catesbeiana* [*Lithobates catesbeianus*] (Figures 30–32)

1 record inside, 1 record outside LNHS area.

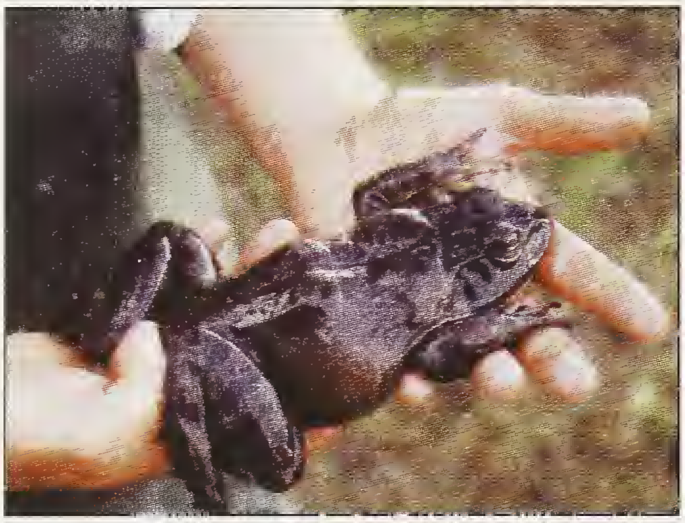


FIGURE 30. American bullfrog adult. *Photo: Kevin Morgan/HCI*

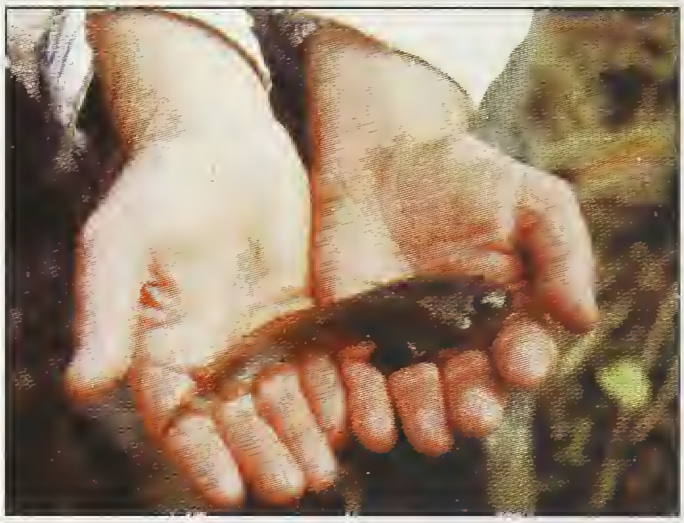


FIGURE 31. American bullfrog tadpole. *Photo: Kevin Morgan/HCI*

FIGURE 32. Bullfrog removal exercise in 1999. *Photo: Kevin Morgan/HCI*

American bullfrog reaches a snout-vent length of up to around 200 mm. It is a dominant amphibian species from North America, also with large tadpoles up to 170 mm in length. The bullfrog call is short repeated bursts of cow-like mooing. It has been spread west over the USA and in many countries, in part due to demand for its leg muscles for human food. It has escaped and been released following attempts to set up commercial breeding farms around the world. The south-west USA has a small southern bullfrog or pig frog *Rana grylio*, that is also taken for food, sold and released outside its range but to a much lesser extent. In Europe, free-ranging American bullfrog populations are located in Belgium, France, Germany, Greece and Italy (Ficetola et al. 2007). Bullfrog tadpoles seem to appear to deter predatory fish such as pike, it is thought by being distasteful to them.

From the mid 1970s, bullfrog tadpoles have been on sale to the public in London, sold at cold water and tropical fish shops, aquatic centres and pet shops. As a result there is no doubt that many tadpoles, froglets and juveniles have been released into gardens and larger ponds and wetland areas. The importation of bullfrog tadpoles has been partly an incidental occurrence, with tadpoles being included in pet trade shipments of American-bred goldfish. One supplier explained that these were added as a free ‘bonus’ from the suppliers with ordered fish. Bullfrog tadpoles are also sent in batches on their own. Bullfrogs are a pest in goldfish farms in North America where they compete for food and are culled (Langton 2002). During 2000, and following publicity, the charity Froglife received enquiries with over half the reports from south-east England: Kent (43), Surrey (11), Greater London (7) and Sussex (10). Scrutiny suggested several were misidentifications. None of the locations were reported to have bullfrog breeding although at eight sites (including five in open habitat and nature reserve settings) follow-up visits seemed a priority. No tadpoles or froglets were detected at the time, but three adult bullfrogs were removed. DEFRA went as far as issuing a statement saying that the public were advised against purchasing them. Further records were obtained following a ridiculous *Evening Standard* 'page a day' hunt for frogs by two London newspaper reporters dressed in safari suits and pith helmets and with a decorated car (Smith and Hayes 1995 *a–d*). Although the publicity had some value, the trivializing of the issue and 'Killer frog' theme was arguably counter-productive to mainstream conservation interests.

There is nevertheless a surprising lack of reporting of large adult bullfrogs calling and breeding over the years, suggesting that conditions in garden ponds are less than ideal for them. This may be due to the late winter (February/March) period in London being too mild and the frogs waking early but being unable to survive early spring through lack of warmth and food. Equally, as with Water Frogs, our summers are often too short and cold for tadpole development. A Declining Amphibians Population Taskforce (DAPTF) worker had indicated that it was unlikely that bullfrogs would become established in the UK (Baker 1995), due to insufficient levels and duration of warmth in the UK for the species to spawn and hatch. Others published concerns that it was an invasive species that was likely to breed in the wild in conditions in England (Cunningham and Langton 1997).

There have since been two incidences of breeding in the London Area. The first was in 1999 a little way outside the LNHS area and around five kilometres south of Edenbridge on the Sussex/Kent border (Banks et al. 2000, Froglife 2000). The other was at a location that adjoins a golf course within the LNHS recording area, near Horndon in Essex in 2008/2009 (Ray Cranfield, pers. comm.). There are also a few other sites in southern England where breeding is known or suspected. At Horndon the origin of the frogs is not exactly known but the proximity of the Mar Dyke river system and ditches, which the local fisheries use to fill their ponds is a potential dispersal route used by Water Frogs and possibly also American bullfrog. At Horndon, bullfrogs were known to have bred in the smaller pond around 2006 but males were calling from two larger lakes where breeding was not observed. Non-breeding American bullfrog records in Essex from wild situations have also been mentioned more recently from Havering, Thurrock, Chelmsford and Southend.

Near Edenbridge in 1999, there were two secluded and warm shallow ponds, closely adjoining each other and one discharging into the other and managed for fly fishing on open farmland. The Environment Agency and the charity Froglife, together with the landowner, located numerous bullfrog tadpoles and froglets leaving the water with residual tails in large numbers. Further details are given in Appendix 4. In urgent response specialist contractors immediately undertook a range of activities to remove bullfrogs in 1999 and 2000, checking initially twenty-three water bodies, farmland ponds and small lakes nearby. In some of these locations they were found to have spread and efforts were made to remove them from those places before they bred. Post-mortem examination of random samples of bullfrogs that were captured and euthanased revealed that the young bullfrogs were eating native species of mammal, amphibian and dragonfly.

The most efficient control method proved to be shooting but because of welfare and health and safety considerations at the location, these methods were not used as part of the approved project control methods. Catching by hand using nets and torches was the most efficient approved method. Electrofishing and the use of crayfish traps were not found to be efficient because the animals were present at relatively low density and were probably too small for electrofishing and because dozens of traps would have been needed for a long time for complete trapping out. It is considered that they could be used effectively and efficiently to collect animals elsewhere when tadpoles/froglets are present at high density although final drainage would remain essential.

Exotic species imported accidentally

There are any number of press cuttings concerning escaped reptiles and amphibians and accidental importations with animals being found in imported fruit, building materials and miscellaneous objects. Yalden (1965) provided an initial baseline of records. These join more recent reports of those found in buildings close to pet shops, in cars and hotel rooms, but as these are not usually considered truly wild they have not been included. Suffice to say that from a constant tide of escapes, it is not surprising that many end up in gardens or open spaces to join those that have been abandoned.

Non-native amphibian and reptile hotspots in and around the London Area

Greenwich sites:

Kidbrooke Green/Birdbrook Road Nature Reserve (NR)

These are urban green spaces, surrounded by dense housing and busy main roads. Together they are well-known locations for non-native European amphibians and reptiles (Snell 1981, 1983, 1984). It is also notable for having the greatest number of introduced non-native herp species recorded in Greater London. Since the 1970s at least seven non-native amphibian and one non-native reptile species have been recorded, some on both sites. There are two areas, one of which (Birdbrook Road NR), adjoins gardens where non-native European species have been kept and moved away from and there is evidence of direct releases into the areas since that time. The area had been proposed for a centre for breeding and keeping of non-native species but as they became more formalized during planning decisions involving changes to the land use, the London Wildlife Trust became more involved and favoured a native-species-only policy.

Charles Snell, a local resident who has kept European species in his back garden adjoining the site, has been involved in both native and non-native European herpetofauna in this area and protecting the wasteland habitat. Having described the native fauna, a number of species began arriving and he began advertising European tree frog and edible/pool frogs bred by him for sale at 50 pence each or for exchange in the British Herpetological Society Bulletin in 1983. In 1993, surveys revealed five species of non-native amphibian were recorded at Birdbrook Road NR and two at Kidbrooke Green in addition to the five native species that were detected during three night-time visits (BHSCC 1993). The Water Frog types located were pool/edible frog, and so potentially marsh frog although these do not seem to have been recorded. London Wildlife Trust conservation staff had concerns about proposals to establish a non-native species breeding centre at the Kidbrooke site and advice on removing those then present was sought. Partly as a result a lock was fixed to the gate to try better to control public access to the area. In the late 1990s there was a report of others in the area keeping non-natives in their gardens and the finding of a dead green toad *Bufo viridis* and a dead banded newt *Triturus vittatus* was reported, apparently with no obvious external signs of cause of death, suggesting that escapes/releases of new species were still occurring and possibly in association with disease. Around this time, awareness of disease transfer from such events was becoming better known.

Newdigate/Beam Brook Nurseries

This location has more non-native herpetofauna than any other site in the London Area or the UK as a whole and has been a major supply source of Water Frogs over an extensive area in Surrey. This includes numbers at the former

Xenopus Ltd site that also had high numbers of non-native species present. Beam Brook non-natives include Alpine newt, non-native crested newt and hybrids/intergrades; European tree frog, fire-bellied toad and wall lizard are also recorded. There are in addition historical records of Italian grass snake, European pond terrapin, fire salamander and green lizard, although the last three have not been seen for many years (Danial Winchester, pers. comm.). In addition Julia Wycherley identified five and suspected up to seven types (species and hybrids) of Water Frog largely from acoustic recordings (Wycherley 2003*a*, Wycherley et al. 2003).

Up to around sixteen different species/types have therefore been reported over the years of which at least eight are considered to have bred. Only the Water Frogs and newts have bred for many years, but the level of any further release of herps at the site over the years seems unreported. Froglife took action to halt the selling of great crested newt/newt hybrids in the mid 1990s by buying some to demonstrate that unlawful sale was taking place and then working with the police to prevent further sale and the resulting releases to the wild through further escape and abandonment.

Hampstead Heath and Epping Forest, north London

In addition to the information on Water Frogs there are a number of other species that have appeared at these large City of London Corporation (CoL) open spaces. These and others such as Burnham Beeches, a few kilometres beyond the LNHS boundary, have been regular dumping grounds for unwanted urban pets due to the proximity of dense housing and large annual visitor numbers. At Hampstead Heath sites, including Golders Hill Park, the Hampstead and Highgate ponds and Kenwood ponds, terrapin numbers peaked around 2007 with up to forty being visible on one day (Adrian Brooker, pers. comm.), although he has seen fifteen or more at one time on the Bird Sanctuary pond alone. There were probably more and a steady number being abandoned each year despite winter mortality. News stories of 150 terrapins present were exaggerated, this figure is closer to representing an estimate of the total number released on the Heath over the years. The CoL authorities discussed the issue of how to deal with increasing numbers from 2006. Humane traps were built and anchored in the ponds in 2007 and sixteen terrapins were initially caught. One idea was to send them to a sanctuary in Italy but rumours of them escaping and breeding there resulted in them being sent to a sanctuary in Norfolk.

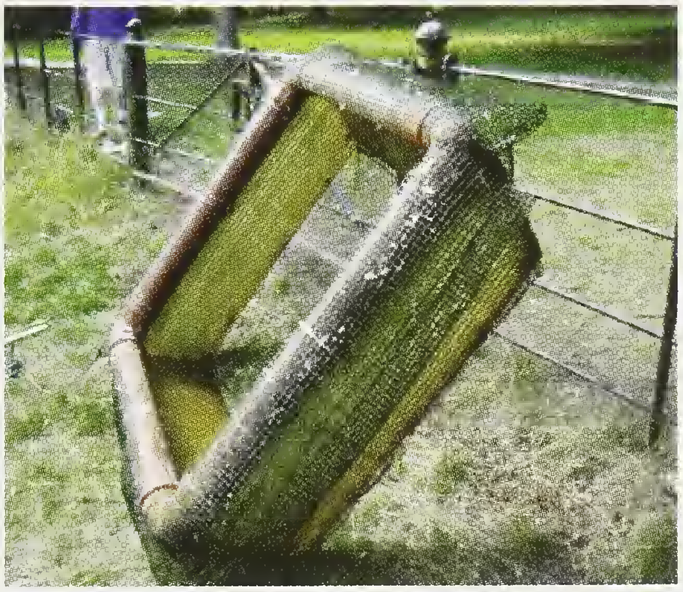


FIGURE 33. Floating basket trap used at Corporation of London and other sites to catch abandoned terrapins. A proportion of terrapins basking on the edge, dive off into the middle when approached. They can then be easily netted as the base is covered by chicken wire, preventing escape. *Photo: City of London Hampstead Heath*

At Hampstead Heath in 2007, one person was intercepted while intending to release four terrapins and the specimens were confiscated. Over the years a number of terrapins have been sent to a large heated conservatory on the third floor of the inner London Barbican Centre where terrapins have been kept (see later). Within the Hampstead Heath sites there have been multiple terrapin species and probably other less-obvious species in many of the ponds including the Stock Pond, Vale of Health Pond, Ladies Ponds and Kenwood Ponds. Even in 2011 a new African terrapin species was captured. Since at least the 1840s at Hampstead Heath and Epping Forest, terrapins, Water Frogs and no doubt many other species have been repeatedly released by the public. These public sites are places with largely unrestricted access by day and night.

Hackney, Walthamstow and the River Lee

Either side of the river that runs through central north London in the centre of dense urban occupation, it is perhaps not surprising that this is a focus for dumped pets in north London. Wanstead Park is a well-known location and Clissold Park has had hundreds of terrapins abandoned there, particularly since 2000. This practice does not seem to diminish as shown by new terrapins arriving after attempted catch-outs. This is since the more-recent desilting operations to improve the conditions as a function of tidying up in advance of the 2012 Olympic Games that seems to have given people the idea that conditions are even more suitable now for them. The extent to which non-native species are being released in urban areas is exemplified by web site blog postings by Jo Wood in 2003. She found in her Hackney garden and in close proximity of Hackney Marshes, an Oriental fire-bellied toad *Bombina orientalis* type, a Water Frog type, European tree frog *Hyla arborea* and green toad *Bufo viridis*. These were probably releases/escapes from an adjoining garden. Generally, as mentioned earlier, Essex has a large number of reports of escaped and released exotic pets. Several aquatic centres and pet shops have a wide range of species regularly for sale including Alpine newt, midwife toad, green toad, marbled newt and green lizard, all sold without guidance to the law in respect of their release.

Problematic aspects of the chelonian pet trade

Unfortunately, according to Andrew Highfield of the Tortoise Trust (web postings) the Mediterranean tortoise trade can be considered as having returned and he reports that large numbers of tortoises, both *Testudo graeca* and *Testudo hermanni*, including the extremely vulnerable Western subspecies, *Testudo hermanni hermanni* are flooding the market described as 'captive bred'. They are reported to be accompanied by fake or fraudulently derived CITES documents giving their origin as either 'Slovenia' or 'Lebanon'. Similarly highly suspect animals accompanied by French, German and Belgian paperwork are also in circulation. Pet stores, garden centres and back-door dealers are offering Mediterranean tortoises in bulk, nearly thirty years since the initial 1984 tortoise import ban. These are illegally collected wild-caught animals that post the 1980s ban initially appeared in a steady trickle, mostly smuggled from Morocco, Tunisia and other localities such as Turkey. Most were sold by small adverts in newspapers — although several of the more unscrupulous 'specialist reptile dealers' were implicated. Vary rarely, a smuggler or dealer would be detected and prosecuted. Today a much bigger and far more effective and profitable fraud has been developed with low risk of being caught, and one designed to mislead tortoise keepers who would not buy other than tortoises with paperwork indicating that they are bred in captivity. A growing proportion of London's pet tortoises are illegally obtained.

The red-eared terrapin, turtle or slider *Trachemys scripta elegans* has been the world's most commonly internationally traded pet reptile for many decades. The history of exploitation of this and other species of terrapins in North America is a long-standing one that has switched from an initial local use of them as human food, then commercialization for the pet trade and then more recently back towards human consumption by Chinese and other Asian US communities, including the extremely concerning mass exportation of this and other species to China. Because of the immediate and urgent nature conservation and animal welfare concerns surrounding this and related species, further details are supplied in Part 2 of this paper.

Harvesting of female terrapins in the USA with an element of ranching to obtain hatchlings from their captive-laid eggs began on a commercial level in the 1940s (Warwick 1991). The initial sale of hatchling terrapins as a children's 'starter' pet within North America rapidly grew in the 1960s. However, as a side effect doctors began to relate a significant proportion of salmonella-related gastric and other bacterial infections in school children to the keeping of terrapins and other pet reptiles. This was probably due to the very hot summer temperatures in parts of the USA and rapid growth of bacteria in terrapin tanks. On public health grounds, the sale of terrapins under 10 cm (4″) was banned across the USA and Canada by 1976. By this time over seventeen million red-eared terrapins had been traded each year. Shortly after the ban a drop in national reptile-related child infection rate was detected and the ban was made permanent. US dealers then began exporting around two million terrapins per year, growing to four to six million by the late 1980s (Warwick 1991). Red-ears were exported for sale as pets, although some countries, e.g., Japan imported them for human consumption.

Hatchling terrapins small enough to fit in the palm of your hand were sold cheaply in London and around the UK, often with a tiny perspex bowl with a small raised central island with a plastic palm tree in the middle. These were sometimes placed in front rooms on sideboards or the top of televisions that then were large, with a warm flat top. Terrapin hatchings are naturally robust, being adapted to emerge from their egg and survive a winter before feeding and so may survive twenty weeks or more before starting to deteriorate. Sold quickly they could remain as unfed ornaments for some time before care became essential. With such a long pre-death period it was harder for people to link cause of death to the pet shop and their unsuitability as pets. Those surviving shipment to pet shops were often sold with the minimum of information and the main income for the shop was selling the housing and pellet food. The trade succeeded, in part because they were so cheap and replaceable. Most hatchlings died in the first three to six months from sale. Those owners complaining were then given a new one by the vendor, up to three times in a row until after many months the proportion complaining reduced, as people gave up trying to keep them or out of guilt that it was their fault that they were dying. Those surviving required a fish tank that was soon outgrown and so sale of a bigger tank was necessary. Tanks required almost daily cleaning due to faecal matter in the water creating a smelly undesirable object in peoples' houses or large pumps and filters could be bought. Over time, many owners cannot cope and those terrapins not dying from neglect are offered around carefully or casually and given away (e.g., when a teenager leaves home), killed or left to escape or released at a local open space.

At one terrapin rescue centre run by Terry Bunn, 'Turtle Rescue', in 2010 they helped rehome from London sources twenty red-eared terrapins, nine yellow-bellied and two map turtles. Five of the red-ears (25 per cent) were captures from the wild. From Surrey, of eight red-ears rescued, one (12.5 per cent) was wild-caught having been brought into a vet's surgery after being found in the wild. These six wild-captured animals represent around four per cent of a total of 138 (97 red-eared and 41 yellow-bellied) unwanted terrapins. Overall at present only a small proportion of abandoned terrapins seem to be recaptured.

There has been no strategy within the small and more serious group of UK terrapin keepers for dealing with the scale of terrapin numbers needing rehoming in any one year and the consequences have been euthanasia or release into the wild, which is cheaper. However, nationally over the last ten years at least 800 terrapins from Britain were sent by the British Chelonia Group to a holding lake project that went wrong in Italy (see Part 2). At least low thousands of terrapins have been euthanased by veterinarians or shot by anglers and park keepers since 2000. This level of removal however may not overall be significant and terrapin numbers at sites where removals have been undertaken are rising again, for example at Clissold Park in Hackney.

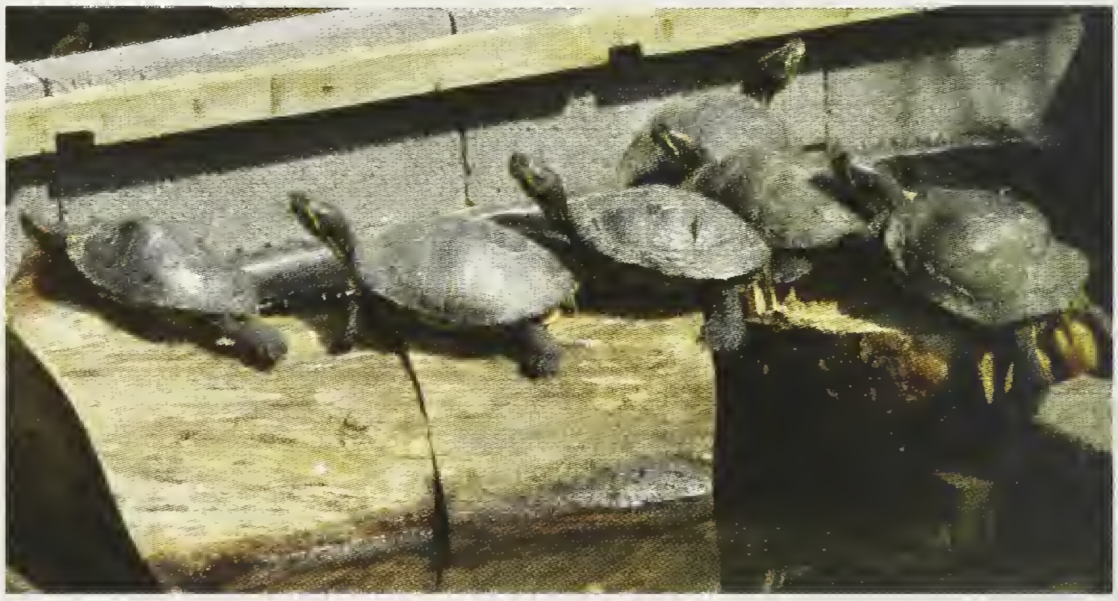


FIGURE 34. Red-eared terrapins removed from Clissold Park in Hackney during refurbishment work. Considerable shell deformities can be observed as a result of poor care during their early years of captivity. *Photo: Roman Muryn*

Ecological impacts and implications

Nature conservation concerns

The pattern of mapped distribution of exotic herpetofauna in general is not surprising. It reflects density of human population, the source of home-keeping of the species and the nearby parks and open spaces where they have subsequently been released. Water Frog and terrapin records dominate and their locations in the wild correspond with wetlands and waterways. Linear progression along waterways is not that obvious in most places but terrapin records are frequent either side of the Thames in central west London and in a line that approximates to the River Lee in central north London. Water Frog records are associated with the edge of the Thames in north Kent, the Mar Dyke in Essex and the rivers in and around the Borough of Hounslow.

Terrapin distribution is well scattered and there are far fewer records on the outskirts of London. This may reflect lower density of recorders. Most of the records fall inside the Greater London boroughs, again a reflection of where many of the exotic species are sold and kept by the general public.

Most of the abandonments of herpetofauna are by the public who buy them, cannot cope or get bored and release them. Equally, those involved professionally working in universities and fisheries, the international transit of animals including airport handling staff and in particular biological supply companies, have allowed or facilitated escapes and releases to occur in a manner that is no longer acceptable. As with intentional releases by hobbyists and birdwatchers, it might be hoped that modern awareness of the risks from letting exotic animals go would have increased. However the evidence points if anything to an increase in releases, perhaps now a slight shift over the last fifteen years from the above-listed professional types to an increase in those released by the public. It seems that anything that is in trade is likely to get released and at present it should be assumed that any species in the general pet trade will in time be found in the wild.

Impacts of exotic herpetofauna in the wild

Recently, interest in the ecological impact and invasiveness threat of species has been under review as the ability to prevent international transfer of species appears to be very limited in the UK and Europe as a whole. Some species such as American bullfrog are out of control in France and a review by the German Federal Environment Agency suggested that eradication in France would cost euro 4.4 billion (Reinhart et al. 2003). In Germany, the same study showed that bullfrogs have colonized in Karlsruhe where five ponds have been pumped out to catch bullfrogs using volunteers but without complete success (Reinhart et al. 2003). An annual anticipated cost of euro 50,000 per pond per year was estimated for future eradication and in the London Area the removal costs at one location exceeded £100,000.

As a general point, the impact on smaller or more-isolated sites such as individual ponds may be more harmful due to the less frequent spatial interchange of species. Awareness of fragmentation as an overarching major issue in nature conservation has grown in recent years. In London, declining species are increasingly isolated, such as the great crested newt *Triturus cristatus*, where seventy per cent of remaining populations are restricted to a single water body for breeding (Atkins and Herbert 2006). Many London sites, as well as rural ones in typical modern agricultural landscapes, are relatively isolated and aquatic animal populations present may be small and already threatened. With the introduction of Water Frog or terrapin species into places where nature is already isolated and suffering inbreeding effects, the arrival of a new mid-range trophic predator could in theory finish off already small and stressed populations of amphibian, crustacean or other invertebrate. The change could be via predation or perhaps even alteration of vegetation or a range of subtle factors.

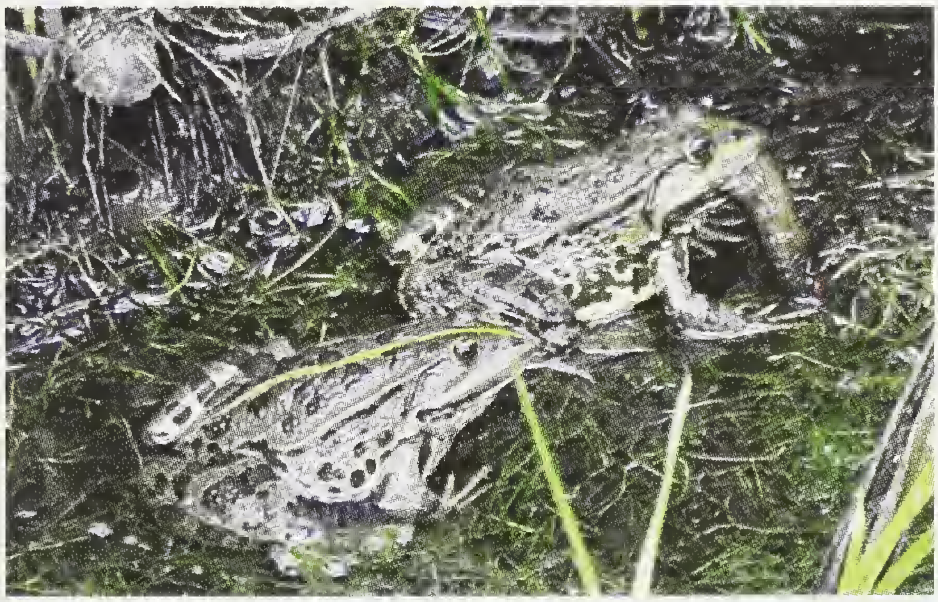


FIGURE 35. Marsh frog type eating water beetle larva (probably great silver water beetle *Hydrophilus piceus*). *Photo: Howard Vaughan*

The increase of predation pressure on prey species both rare and common is an obvious risk from escapes and releases of exotics. Autopsies of American bullfrogs in France has suggested that forty per cent of their diet is made up of native frog species, thirty-four per cent was fish, seventeen per cent insects and four per cent molluscs. Cannibalism represented three per cent of food items, and very small mammals and birds have been observed as being taken. With Water Frog, an impact upon the local fauna is also likely and anecdotal reports of them suppressing numbers of other species is similar to the manner that other dominant amphibians can achieve, e.g., large great crested newt populations can suppress common frog and smooth newt numbers in a pond. With the taking of juvenile water birds and other small vertebrates, the terrapin species likely to do this are the common snapping turtle, alligator snapping turtle and possibly the softshells but not the red-ears and yellow-bellies that get blamed. Given the low level of release of the more predatory species the threat is relatively low although little is known of the extent of impact when it occurs. There have been a few reports of frogs and ducks with missing limbs but these can be due to many causes. A few cases were also mentioned by the National Terrapin Survey and are sometimes attributed to terrapins often without any evidence. On larger sites as well as on rivers and canals these events are more likely to be from northern pike *Esox lucius* or other large predatory fish. At some sites where ducklings diminished, such as Sheepwash Pond in Barnet, there was no clear evidence of predation by terrapins despite media claims although a softshell was present. Here diminished pond quality may have been more an impact due to terrapins consuming vegetation, combined with the over-feeding of ducks and consequent eutrophication. Elsewhere there has been some suggestion that terrapins can bask on waterfowl nests and hence displace water birds and predate eggs and chicks.

Introduced species may be consumed by species in the community into which they are placed and to an extent that may be highly significant. This offers a direct pathway for pathogen transfer between species that have not been in contact with each other. A recent example in London of this was feeding by grey heron, lesser black-backed gull and carrion crow on the introduced thin-clawed Turkish crayfish *Astacus leptodactylus* in The Serpentine and The Long Water over the last decade (Wiltshire and Reynolds 2006).

Marsh frog type at RSPB Rainham marshes are watched most of the time by birdwatchers and have been seen to be predated by grey heron, great white egret (a rare visitor), little egret, red fox, kestrel, carrion crow, stoat, weasel, kingfisher (taking young-of-year froglets), marsh harrier and grass snake (H. Vaughan, pers. comm.). They seem to be an integral part of trophic transfer at an increasing number of sites and may even increase species richness at a large site at least in the short term. The minimum size of ponds/wetland at which the arrival of a large abundant species as marsh frog does not negatively impact prey fauna via predation is not known but long-term studies might be useful.

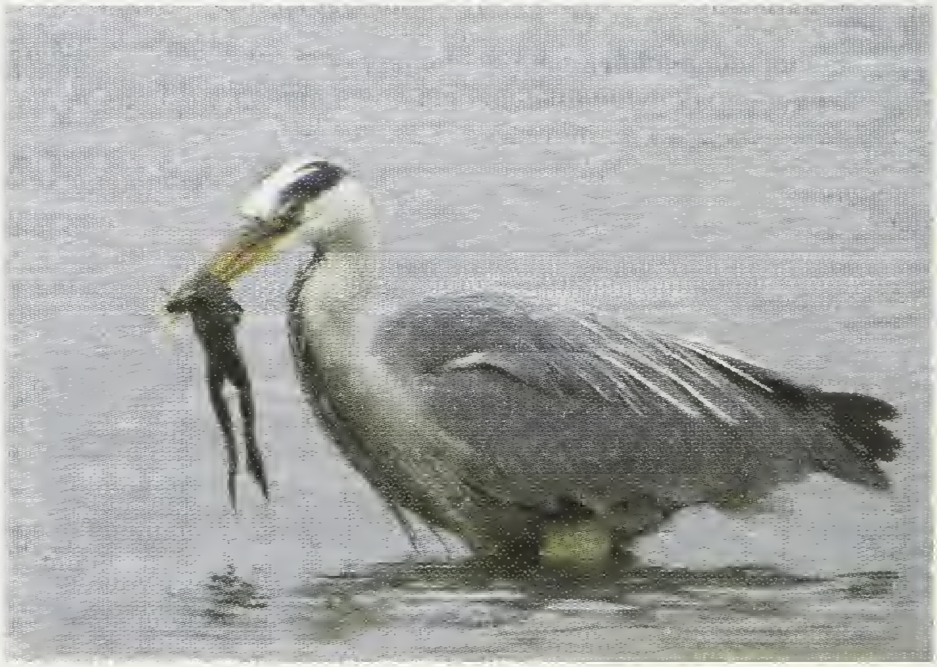


FIGURE 36. Grey heron catching an adult marsh frog type at RSPB Rainham Marshes.
Photo: Freddie Roll

There are clearly limitations with many species' ability to breed in the London Area climate. Water Frogs seem to have better breeding years in long hot summers, illustrating their range-edge limitations. Released terrapins may mate in the wild and do so when kept at rescue centres. We came across several records of terrapins nest building and egg laying in London on banks and islands around ponds and lakes and the laying or jettisoning of eggs by freshly caught females. Captured wild-caught females at one rescue centre dug holes in a garden but did

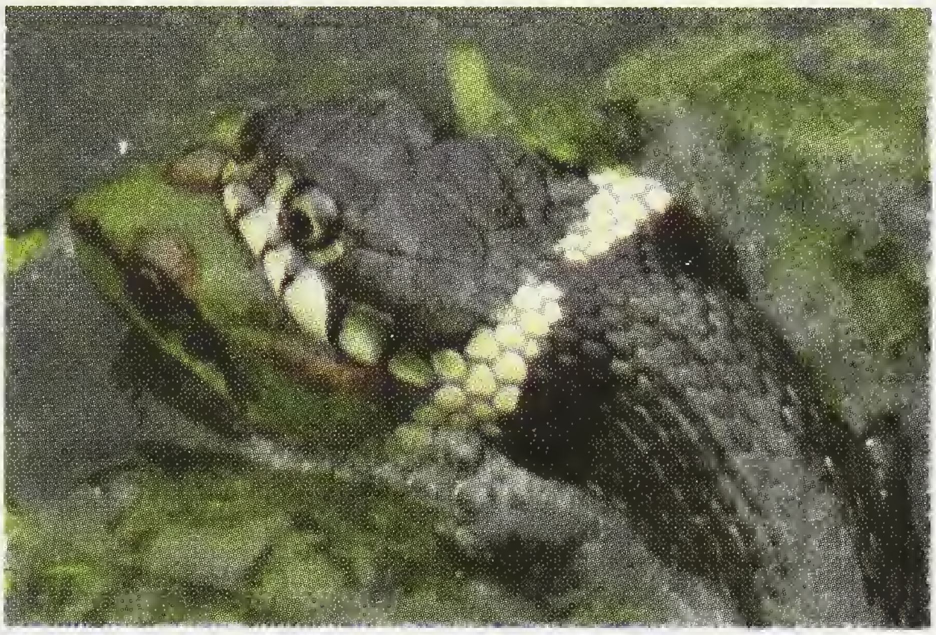


FIGURE 37. Grass snake swallowing marsh frog type at RSPB Rainham Marshes.
Photo: Sula Riedlinger

not seem to lay a 'proper' nest and instead released the eggs into their retaining pool. It is not known if the eggs are fertile as no one seems to have incubated them although Wayne Rampling reports successfully incubated yellow-bellied slider eggs from a captured female. Although she looked like she had been in the wild some time it is not certain that she had not mated prior to being abandoned. The fact that hatchling terrapins have not been seen after many instances of opportunity in London and elsewhere implies that wild breeding has not as yet occurred but that might not be the case with other species, given time.

At present, damage by terrapins and Water Frogs from their competitive and predation forces is more theoretical than proven due to lack of research. Many urban situations are so disrupted that the relative importance of it seems lower than elsewhere on nature reserves or good quality less-protected areas. Impacts may be significant and even cause the disappearance of other species, such as aquatic snails.

Trends in London's wild terrapin numbers

The National Terrapin Survey (Weeks 1995, 1997) guesstimated that there would be a national UK non-breeding wild terrapin 'population' of around 1,500, by 2000. Guesstimating numbers today is not simple but the following figures are an attempt at approximation. The figures may well be wrong but are offered as a basis for further consideration and refining. Trends may vary from area to area and in places including park ponds it is suspected that some people taking in terrapins for rehoming actually then take them for outdoor release in a regular location where they carry out multiple releases over many years.

In the past, if the UK has had up to 300,000 terrapins imported each year until 1997, then it may have imported around four million since 1960. Based upon an average of around 250,000 mixed terrapin species imported for sale per year, if London has ten to twelve per cent of UK households, this might suggest that at least 25,000 terrapins were traded here each year. Of these, say ten per cent (2,500) survived until one-year old. If ten per cent of these survivors are released in the wild, around 250 have been released in the London Area per year and 2,500 (25,000 nationally) in the ten years to 1997. This might imply that the NTS survey was an underestimate or that most terrapins released died within a year or so which is also quite possible.

Today, terrapin numbers sold annually are less well monitored yet probably lower on average than that prior to the 1997 attempted trade controls, but some of the new species being released may be better at surviving.

Overall, the anecdotal impression gained from the records and accounts gathered for this study is that at some locations released terrapins can survive for longer than one year. There do not seem to be records of long-term survival. Survival is perhaps split into two classes: those dying in one to three years from release in the most unsuitable places (or unhealthy/stressed) and those surviving for up to ten years or more at sites with better quality thermal, water purity and food (aquatic plant) conditions. This could be further investigated. Equally, numbers being released in the London Area seems to be higher than 125 per year and could perhaps be as high as 1,000, but it is not currently possible to judge. From this we guesstimate minimum UK wild (abandoned) terrapin numbers for 2010 at around 4,000 with up to 1,000 (twenty-five per cent) within the LNHS recording area, most of which are within Greater London. Annual mortality of abandoned terrapins might be expected to vary somewhere between forty and eighty per cent and be highest in periods when winter ice cover exceeds two weeks.

Numbers of bullfrogs can clearly grow very rapidly with such a fecund species, but control efforts seem to have worked at the two sites and further cases that are in hand elsewhere in England. Water Frog removal has not been attempted to our knowledge but the impression gained is that although numbers can build up to high levels, very rapid spread is not a feature of these species if the habitat is interrupted by lower quality habitat, unless additional movements by human transfer is also taking place, as is the case with marsh frog type in Kent.

Acknowledgements

This review has combined older information with first-hand findings over the last forty years or so, involving a large number of people, and some friends who are no longer with us. LNHS members who often have many other 'hats' and who have contributed significantly and been particularly helpful over the years include John A. Burton, Derek Yalden and the late Richard Fitter. Early on others such as Keith Corbett, Colin Plant, the late Bunny Teagle, the late Kate Springett and the late Brad Ashby showed interest that helped initiate recording interests. In Surrey the late Julia Wycherley and Alan and Christopher Sauvarin are worthy of special mention. Julia because she was one of a handful of people interested and active in all aspects of herpetofauna conservation in the 1980s. She helped to progress (with TESL and CH and others) the Herpetofauna Groups of Britain and Ireland (HGBI, now ARG UK) that thrived and grew in the 1990s to form the core of our current national efforts. Alan and son Christopher, who had a passion for informed wildlife population management and humane control of non-native species, and Ray and Jon Cranfield, are active in Essex.

Record Centres and charities that work with recorders and hence that have primary record-making capacities and that have assisted in some way in the supply or records include BRIE/Essex Wildlife Trust, Bedfordshire and Luton Biodiversity Recording and Monitoring Centre, Buckinghamshire and Milton Keynes Environmental Records Centre, Hertfordshire Biological Records Centre, Kent and Medway Biological Records Centre, Kent Reptile and Amphibian Group, London, Essex and Hertfordshire Amphibian and Reptile Trust (formerly London Amphibian and Reptile Group and incorporating the Hertfordshire and Middlesex Herpetological Standing Committee), London Ecology Unit, Passmore Edwards Museum and Southend Biological Records Centre. Buckinghamshire, Essex, Surrey and Kent, Amphibian and Reptile Groups have all assisted with records as have the Essex and Kent Field Clubs.

The account draws on a considerable amount of research and activity by commercial consultancies and work created by industry and government commissions. Over the last twenty-five years these have appeared and have taken centre stage in conservation work, often tackling situations where land use change from development initiates a wide range of professional response including ecological and practical/policy evaluation, survey and or practical habitat and species management work. These bodies include Amphibian Reptile and Mammal Conservation Ltd, GPM Ecology, Herpetofauna Consultants International Ltd (HCI staff working on non-native species control work include Catherine Langton, Kevin Morgan, Terry Venn and Andrew Wilson) and The Ecology Consultancy.

In local and national government, government agencies and authorities there has been considerable effort in addressing non-native species issues and assistance with our research. Some now include routinely aspects of record keeping in nature conservation and open-space management bodies. Individual support and expertise have been generously offered by Brian Banks (English Nature), Leslie Williams (Brent Council), Doug Napier (London Borough of Hounslow/Merton Councils), Mike Dickson (London Borough of Haringey) and Camden Council. Ges Hoddinott of the the Lee Valley Regional Park Authority is also thanked. Often these dedicated government workers have contributed additionally in their own time to make sure formal situations are covered and giving extra value to the official duties. City of London staff assisting include those from Hampstead Heath, Epping Forest, Burnham Beeches and other sites; Adrian Brooker, Neil Anderson, Phil Murfin and Helen Read in particular are thanked. Bob Quest at the Heathrow Animal Quarantine Station (now the Heathrow Animal Reception Centre) has been a sound source of advice and information over the years and has witnessed incredible human abuse of animals in trade and provides a balanced insight on trade and welfare matters. Members of the London Ecology Unit and subsequent bodies including the Greater London Authority concerned with nature conservation have assisted in many ways.

At Regent's Park, David Ball and Ester Wenman of the Zoological Society of London were very helpful contacts in the 1980s. More recently at the Institute of Zoology Andrew Cunningham has worked with TESL on studies of disease that appears to have originated from non-native species releases in urban and rural areas in London and elsewhere in the UK, and on pathogen transmission. Sue Thornton has provided a valuable insight into rescue centre infections and euthanasia. Others offering information advice and relevant reference material include Elaine Toland (Animal Protection Agency), Clifford Warwick (EVF), many RSPCA staff and Chris Miller and George Oxendale of HM Customs & Excise (now HM Revenue & Customs).

Terrapin welfare and rescue people who have explained and elaborated on many aspects of the terrapin trade and terrapin keeping include Terry Bunn of Terrapin Rescue, Wayne Rampling of Turtle Squad Harwich, New Terrapin Rescue, and representatives answering e-mails/telephone enquiries from Thanet Tortoise Rescue, Turtle and Terrapin Rescue, Kent and South London Tortoise Group, and The Tortoise Trust where Andy Highfield runs an excellent website. Trevor Weeks who ran a National Terrapin Survey in the 1990s provided further comments and details concerning his records checklists. Thanks are also due to Paul Eversfield, Paul Coleman and particularly Roman Muryn who has been especially helpful with aspects of terrapin identification, advice on a wide range of aspects of terrapin captive care and rehoming as well as supplying many excellent photographs.

The American bullfrog control work south of the Thames involved dozens of people and organizations. These included the national conservation charity Froglife, the two government agencies Natural England and The Environment Agency, numerous landowners and a wide range of practical and nature conservation and countryside contractors. Bullfrog records were made by a variety of people at the site near Edenbridge from 1996 to 2007, Kevin Morgan (for HCI and Froglife) and Brian Banks (English Nature) did the brunt of the fieldwork, assisted by many others including John Wykes, Mick Ross Halcyon Landscapes, Gareth Matthes, Daniel Bennett, and fisheries teams from the Environment Agency and many cooperative landowners.

There are many other unpaid/volunteer workers who have done more than a little to improve our understanding of and proper approach to non-native species issues, including in Surrey, Steve Langham, Gareth Matthes, Jamel Guenioui and Danial Winchester, in Greater London; Clive Cohen (London Wildlife Trust) and Lawrence Bard (Pondlife). Others who have contributed in some way to this review include Dave Bird, Rita Capecchi, Ched George, John Gaughan, Howard Inns and Graeme Skinner.

Amongst professional non-government/wildlife charity workers, many have contributed in some way, including Jeff Edwards and others at London Wildlife Trust, Howard Vaughan of the Royal Society for the Protection of Birds at RSPB Rainham Marshes. Froglife staff contributing over the years include Jim Foster, Rona Gibb, Sarah Giles and Mary Candler. Work undertaken by Froglife regarding invasive species control work has been financially supported by the Ernest Kleinwort Charitable Trust and HCI Ltd, and includes contribution contract funding by English Nature. Kim Kitson of The National Trust and a range of National Trust, English Heritage, Royal Parks and other park-keeping and gardening staff and volunteer workers are also thanked for new records, observations and advice on tracing records. Numerous photographers have assisted and donated images; they are credited with photograph captions. Information has also been gathered from a range of internet sites and blogs such as those of the British Dragonfly Society and the 'maggot drowner' angling blog.

Species records have been located or kindly provided by the following persons, apologies if anyone has been missed off. The list does not include every recorder from previously published LNHS records if they have been mentioned in past accounts. S. Allday, N. Anderson, D. Andrews, C. B. Ashby, L. Baard, B. Banks, R. Barnes, P. Barnham, L. Barrett,

J. Barrington, L. Batten, I. Beames, D. Bird, Dr Birnsting, B. Bligh, C. Boase, A. Boucher, N. Bowman, L. Brady, J. Briggs, A Boucher, H. Brindley, A. Brown, A. Brooker, J. A. Burton, I. Cardy, S. Brewer, B. Chard, A. Cheeseman, J. Clarke, C. Cohen, D. Coleman, K.Corbett, J. Cotton, M. Clark, R. and J. Cranfield , N. Croft, F. Crumley, P. Dawe, A. Dickenson, J. Dobson, J. Edgington, C. Everett, V. Evershed, P. Eversfield, D. Eyemott, D. Faulkner, S. Fell, P. Ferris, R. Fitter, N. Flack, C. Flower, J. Foster, J. Frazer, B. Frearson, A. Hicks, P. Gasson, J. Gaugham, S. Garlick, N. Garbutt, C. George, B. Gilbert, M. Gill, B. Gillam, A. Gibson, S. Gibson, H. Graves, M. Green, V. Green, P. Guest, G. Gush, J. Goddard, I. Greenwood, D. Hall, G. Halliday, A. Hicks, M. Hardwick, D. Herringshaw, G. Hoddinott, D. Howden, A. Hutson, H. Inns, B. Jackson, M. Jennings, R. Kettle, R. Kaye, M. Kerr, S.Kerr, P. King, P. Kinnear, R. Kettle, K. Kitson, S. Langham, M. Lambert, K. Livingstone, R. Luck, G. Matthes, M. Massie, D. McKenzie, D. Miller, R. Miller, J. Mitchell, P. Moore, K. Morgan, L. Moss, P. Morris, P. Murfin, D. Napier, P. Newham, L. Nicholson, P. Nicholson, R. Oates, S. Ogram, A. Paine, H. Papazyan, A. Petrie, L. Pidgeon, P. Pillorow, C. Plant, M. Prime, C. Poore, A. Quigley, C. Quinby, B. Quest, B. Rafferty, W. Rampling, H. Read, D. Rear, M. Reed, C. Rose, L.Rowe, A. and C. Sauvarin, A. Scott, A. Self, K. Seamans, G. Sidoli, G. Skinner, C. Snell, P. Sutton, Mr Tanner, L. Taylor, W. G.(Bunny) Teagle, J. Tester, P.Tinning, T. Tonovan, R. Troust, A. Tucker, J. Turner, R. Turner, T. Turner, N. Upton, H. Vaughan, A. Walker, A. Waller, P. Wallace, M. Warburg, K. Warren, E. Wenman, R. Wenham, N. Wilkinson, D. Winchester, A. Wilson, W. Wilson, L. Williams, S. Weeks, M. Worms, J. Wycherley, D. Yalden, J. Young.

LNHS officials have assisted in several ways. Mick Massie helped convince TESL that it was time to write up and this led to a joint venture with Clive Herbert and Will Atkins of LEHART to get it done. David Howden and Mike West are also thanked for assistance and the Council for a grant to enable the excellent terrapin illustrations to be prepared by Denys Ovenden. Last but not least are thanks to our diligent, patient and long-standing editor Keith Hyatt who helped throughout preparation and production.

References

ANON. 2005. Deported terrapins innocent. *Edgware Times,* 6 October.

BRITISH BROADCASTING CORPORATION. 2009. *Virus may be harming sand lizards.* BBC News Web pages, 23 November posting.

ARMITAGE, P. L. and WEST, B. 1985, with contributions from CLARKE, B. T., DYSON, T., FESTING, M. F. W. and LOCKER, A. Faunal evidence from a late medieval garden well of the Greyfriars, London. *Trans. Lond. Middx arch. Soc.* **36**: 107–136.

ARNOLD, E.N., BURTON, J.A. and OVENDEN, D.W. 1978. *A field guide to the reptiles and amphibians of Britain and Europe.* Collins, London.

ATKINS, W. and HERBERT, C. 2006. Status of the crested newt *Triturus cristatus* in Greater London in 1995. *Lond. Nat.* **75**: 67–74.

BAKER, J. 1995. Bullfrogs. *Young Herpetologists' Newsletter* **50**: 13.

BANKS, B., FOSTER, J.P., MORGAN, K. and LANGTON, T.E.S. 2000. British bullfrogs? *Br. Wildlife* 327–330.

BARTLETT, R.D. 1987. Some random thoughts on hobbyists. *Bull. Br. herpet. Soc.* **19**: 34–36.

BEEBEE, T. J. C., BUCKLEY, J., EVANS, I., FOSTER, J. P., GENT, A. H., GLEED OWEN, C. P., KELLY, G., ROWE, G., SNELL, C., WYCHERLEY, J. T. and ZIESSET, I. 2005. Neglected native or undesirable alien? Resolution of a conservation dilemma concerning the pool frog *Rana lessonae. Biodiversity and Conservation* **14**: 1607–1626.

BELL, T. 1849. *History of British reptiles.* Ed.2. Van Nostrand, London.

BOEHME, G. 1977. Zur Bestimmung quartarer Anuren Europas an Hand von Skelettelementen. *Wiss. Z. Humbolt-Univ. Berl.*, **26**: 283–300.

BOEHME, G. and GUNTHER, R. 1979. Osteological studies in the European Water Frogs *Rana ridibunda, Rana lessonae* and *Rana 'esculenta'* (Anura, Ranidae). *Mitt. zool. Mus. Berl.* **55**: 203–215.

BOND, F. 1844*a*. Notes on the occurrence of the edible frog in Cambridgeshire. *Zoologist* **II**: 393.

BOND, F. 1844*b*. Note on the edible frog. *Zoologist* **II**: 677.

BOULENGER, G. A. 1884*a*. On the origin of the edible frog in England. *Zoologist*, Ser. 3, **VIII**: 265–269.

BOULENGER, G. A. 1884*b*. Notes on the edible frog in England. *Proc. zool. Soc. Lond.* 1884: 573–576.

BREDE, E.G., THORPE, R.S., ARNTZEN, J.W. and LANGTON, T.E.S. 2000. A morphometric study of a hybrid newt population (*Triturus cristatus*/*T. carnifex*): Beam Brook Nurseries, Surrey, U.K. *Biol. J. Linn. Soc.* **70**: 685–695.

BRITISH HERPETOLOGICAL SOCIETY CONSERVATION COMMITTEE. 1993. *A2 Kidbrooke Park Road Interchange improvement: a survey of amphibians and aquatic invertebrates at Kidbrooke Green and Birdbrook Road Nature Reserve.* A report to DH Associates and the Department of Transport.

BURTON, J. A. and LANGTON, T. E. S. 2005. *On the approach to investigating the historic status of the Green/Water frog* Rana lessonae *in England using archive material, with particular reference to English Nature funded Research Reports and proposals to release pool frogs in the wild in England.* 1st report of the Green Frog Information Programme (GRIP). Herpetofauna Consultants International, Bramfield.

CLARK, M. 2001. *Mammals, amphibians and reptiles of Hertfordsire.* Hertfordshire Natural History Society.

COOKE, M.C. 1893. *Our reptiles and amphibians.* W. H. Allen & Co.

CUNNINGHAM, A.A. and LANGTON T.E.S. 1997. Disease risks associated with translocations of amphibians into, out of, and within Europe — a U.K. perspective. *J. Br. Vet. Soc.* **2**: 37–41.

DALGLEISH, G. 1904. Occurrence of the edible frog (*Rana esculenta*, forma typica) in Surrey. *Zoologist* **8**: 352–353.

EDLIN, H.L. 1952. *The changing wildlife of Britain.* Batsford, London.

EDWARDS, D.M.E. 1953. Viperine snake *Natrix maura* in Kent. *Br. J. Herpet.* **1**: 174.

ELLIS, R. 1985. Excavations at 9 St. Clare Street. *Lond. Archaeol.* **5**: 115–121.

ERNST, C.H., LOVICH J.E. and BARBOUR, R.W. 2009. *Turtles of the United States and Canada.* Ed. 2. John Hopkins University Press, Baltimore.

FICETOLA, G.F., COIC, C., DETAINT, M. and BERRONEAU, M. 2007. Pattern of distribution of the American bullfrog *Rana catesbeiana* in Europe. *Biol. Invasions* **9**: 767–772.

FITTER, R.S.R. 1949. A check-list of the mammals, reptiles and Amphibia of the London Area 1900–1949. *Lond. Nat.* **28**: 98–115.

FITTER, R.S.R. 1959. *The ark in our midst.* Collins, London & Glasgow.

FITTER, R.S.R. 1960. Further records of mammals, reptiles and Amphibia of the London Area. *Lond. Nat.* **39**: 18–21.

FORD, M. 1982. *The changing climate responses of the natural flora and fauna.* George Allen & Unwin, London.

FRANKE, J. and TELECKY, T.M. 2001. *Reptiles as pets. An examination of the trade in live reptiles in the United States.* The Humane Society of the United States.

FRAZER, J.F.D. 1964. Introduced species of amphibians and reptiles in mainland Britain. *Br. J. Herpet.* **3**: 145.

FROGLIFE. 2000. *Summary report on American bullfrog containment at land at Cowden, Sussex/Kent border in 2000.* Unpublished. Froglife, Halesworth.

GASC, J.P. (Ed.). 1997. *Atlas of amphibians and reptiles in Europe.* Museum of Natural History on behalf of the European Herpetological Society, Paris.

GILLETT, L. 1988. Beambrook aquatic nurseries: an update. *Bull. Br. herpet. Soc.* **26**: 31.

GILSEN, T. and KAURI, H. 1959. Zoogeography of the Swedish amphibians and reptiles with notes on their growth and ecology. *Acta vertebra.* **1**, No.3.

GLEED-OWEN, C.P. 2000. Subfossil records of *Rana* cf. *lessonae*, *Rana arvalis* and *Rana* cf. *dalmatina* from Middle Saxon (*c.*600–950 AD) deposits in eastern England: evidence for native status. *Amphibia–Reptilia* **21**: 57–65.

HAMPSTEAD SCIENTIFIC SOCIETY. 1913. *Hampstead Heath. Its geology and natural history.* T. Fisher Unwin, London.

HIBBERD, H. 1991. *Amphibian studies in archaeology; an analysis of the small animals from the St. Clare Street pit.* Zooarchaeology M.Sc. dissertation, Museum of London Greater London Environmental Archaeology Section.

JOSLIN, P. A. and WYCHERLEY, J.T.M. 1994. *Green frogs in the UK. Distribution and ecology.* Unpublished manuscript.

KING, P.W. 1981. Amphibia and Reptilia in the London Area 1979–1980. *Lond Nat.* **60**: 96–99.

LANGTON, T.E.S. 1991. Distribution and status of reptiles and amphibians in the London Area. *Lond. Nat.* **70**: 97–123.

LANGTON, T.E.S. 2002. On the trail of the serial killer. February edition. *BBC Wildlife Magazine*. Bristol.

LANGTON, T.E.S. and BURTON, J.A. 1997. *Amphibians and reptiles: conservation management of species and habitats.* Planning and management series No. 4, Council of Europe, Strasbourg.

LANGTON, T.E.S. and BURTON, J.A. 2005. Pool frog *Rana lessonae* in Britain: past nativeness unresolved. On the verification of sub-fossil bone identification. *2nd report of the Green Frog Information Programme (GRIP).* Herpetofauna Consultants International, Bramfield.

LEUTSCHER, A. 1952. *Vivarium life. A manual on amphibians, reptiles and cold water fish.* Cleaver-Hume Press, London.

LE SUEUR, F. 1976. *A natural history of Jersey.* Phillmore & Co., London.

LEVER, C. 1977. *The naturalized animals of the British Isles.* Hutchinson, London.

LEVER, C. 2003. *Naturalised reptiles and amphibians of the world.* Oxford University Press.

LEVER, C. 2009. *The naturalised animals of Britain and Ireland — mammals birds reptiles amphibians and fish.* New Holland Publishers (UK) Ltd, London.

LLOYD, I. 2005. Terrapins strike terror into Sheepwash Pond. *Edgware Times*, 5 August.

LONGCORE, J. E., PESSIER, A. P. et al. 1999. *Batrachochytrium dendrobatidis* gen. et sp. nov., a chytrid pathogenic to amphibians. *Mycologia* **91**(2): 219–227.

MALENOIR, G. 1963. Further notes on the reptile and amphibian survey of Epping Forest 1959–1961. *Essex Nat.* **31**:141–147.

MEDICAL RESEARCH COUNCIL. 1968. *International index of laboratory animals.* Medical Research Council Laboratory Animals Centre. 84 pp.

MOLE, S.R.C. 2010. Changes in relative abundance of the western green lizard *Lacerta bilineata* and the common wall lizard *Podarcis muralis* introduced onto Boscombe Cliffs, Dorset, UK. *Herpet. Bull.* **114**: 24–29.

NAPIER, D.W. 2006. *The impact of the non-native marsh frog* Rana ridibunda *(Pallas, 1771) and other introduced Water Frogs* Rana *spp. upon the common frog* Rana temporaria *(Linnaeus, 1758) and other native amphibians in Britain.* Dissertation: Birkbeck College, University of London.

NEWMAN, E. 1848. Naturalisation of *Rana esculenta* at Epping. *Zoologist* **VI**: 2268.

PENNANT, T. 1776. *British zoology*, 4 vols. Benjamin White, London.

PHILP, E. G. 1998. *Provisional atlas of the reptiles and amphibians of Kent.* Kent Field Club 15: Part 2.

PLANT, C. 1983. *A provisional atlas of the amphibians and reptiles of Essex.* Essex Biological Record Centres. Publication No.2, Passmore Edwards Museum, Romford.

QUENNELL, P. 1984. *Mayhew's London.* Bracken Books, London.

REINHART, F., HERLE, M., BASTIANSEN, F. and STREIT, B. 2003. *Economic impact of the spread of alien species in Germany.* Federal Ministry of the Environment, Nature and Nuclear Safety, Berlin.

RSPCA. 1979. *The tortoise trade.* A report on an investigation carried out by The Royal Society for the Prevention of Cruelty to Animals. Horsham.

SCHMELLER, D.S., PAGANO, A., PLENET, S. and VEITH, M. 2007. Introducing Water Frogs — is there a risk for indigenous species in France? *C. R. Biol.* **330**: 684–690.

SHAW, G. 1802. General Zoology 2: Amphibians and Reptiles. *Phil. Trans. R. Soc.* **92**: 531.

SMITH, G. and HAYES, T. 1995*a*. Killer frog patrol. *Evening Standard*, 1 August.

SMITH, G. and HAYES, T. 1995*b*. Clapham gets jumpy. *Evening Standard*, 2 August.

SMITH, G. and HAYES, T. 1995*c*. GOTCHA! *Evening Standard*, 3 August.

SMITH, G. and HAYES, T. 1995*d*. Dangerous Frogs Act soon, says Livingstone. *Evening Standard*, 4 August.

SMITH, M. A. 1951. *The British amphibians and reptiles.* Collins, London.

SNELL, C. 1981. Breeding the European tree frog *Hyla arborea* and a note on a wild breeding of *Podarcis muralis* in England. *Bull. Br. herpet. Soc.* **3**: 48.

SNELL, C. 1983. Miscellaneous notes on European tree frogs, edible frogs, crested newts and wall lizards *Bull. Br. herpet. Soc.* **7**: 51–54.

SNELL, C. 1984. Observations on the Birdbrooke site, London S.E.3. *Bull. Br. herpet. Soc.* **10**: 55–56.

SOMMER, R.S., LINDQVIST, C., PERSSON, A., BRINGSOE, H., RHODIN, A.G.J., SCHNEEWEISS, N., SIROKY, P., BACHMANN, L. and FRITZ, U. 2009. Unexpected early extinction of the European pond turtle (*Emys orbicularis*) in Sweden and climatic impact on its Holocene range. *Molec. Ecol.* **18**(6): 1252–1262.

STILES, D. 1979. The common wall lizard *Podarcis muralis* in Middlesex. *Lond. Nat.* **58**: 25–26.

TINSLEY, R.C. and SIMMONDS, M.P. 1987. Xenopus *predation on native amphibian larvae.* Unpublished report to Nature Conservancy Council. Queen Mary College, London.

WARWICK, C. 1987. The decline of the North American box turtles. *Animals Int.* 7: 23.

WARWICK, C. 1991. Conservation of red-eared terrapins *Trachemys scripta elegans*: threats from international pet and culinary markets. *Testudo* **3**: 34–44.

WEEKS, T. 1995. *National Terrapin Project.* Manual version 2. Unpublished.

WEEKS, T. 1997. *National Terrapin Project, summary of distribution data.* Unpublished.

WELDON, C., DU PREEZ, L.H., HYATT, A.D., MULLER, R. and SPEARE, R. 2004. Origin of the Amphibian Chytrid Fungus. *Emerging Infectious Diseases* **10**: 12.

WILTSHIRE, E. and REYNOLDS, J.D. 2006. Bird predation on Turkish crayfish in central London. *Lond. Nat.* **85**: 121–124.

WOLLEY J, 1847. Is the edible frog a true native of Britain? *Zoologist* **5**: 1821–1822.

WOLLEY, J. 1849. Some remarks on British amphibia. *Zoologist* **8**: 2655–2658.

WOLLEY, J. 1859. Is the edible frog a true native of Britain? *Zoologist* **17**: 6606–6609.

WYCHERLEY, J. 2003*a*. *Bioacoustics and ecology of European Water Frogs.* PhD thesis, University of Sussex.

WYCHERLEY, J. 2003*b*. Water frogs in Britain. *Br. Wildlife.* **14**(4): 260–269.

WYCHERLEY, J. and ANSTIS, R. 2001. *Amphibians and reptiles of Surrey.* Surrey Wildlife Trust.

WYCHERLEY, J., DORAN, S. and BEEBEE, T.J.C. 2003. A preliminary study of a one-hundred-year-old introduced population of Water Frogs. *Herpet. Bull.* **84**: 21–29.

YALDEN, D.W. 1965. Distribution of reptiles and amphibians in the London. *Lond. Nat.* **44**: 57–69.

YALDEN, D.W. 1967. Reptiles and amphibians in the London Area 1965–1966. *Lond. Nat.* **46**: 68–75.

YAPP, R. 2004. The terrapin terror. *Daily Mail,* 7 August.

APPENDICES

APPENDIX 1. Notes on climatic and zoogeographic considerations relating to exotic herpetofauna in London and southern England in general

The tendency of humans to move animals around and to release them presents a degree of confusion in zoogeography throughout the world. One of the earlier records of amphibian transfer is that of the fire toad or fire-bellied toad *Bombina bombina*, a species thought close to extinction in 1900 in Sweden. Its survival is proposed by some to be the result of releases by the wealthy Danish Chancellor Peder Oxe (1520–1575), quite possibly the first person documented as trying to acclimatize a wild animal by wild-to-wild transfer. Nearly 300 years before the European Acclimatization Societies began in the 1850s, Oxe moved what became known as 'Peder Oxe's frogs' into Denmark and south Sweden, releasing them throughout his estates and elsewhere. Their presence, with its distinctive male 'booming' call, appears to have been as a status symbol, the details of which do not appear to have been, yet might usefully be researched.

Toads were moved alongside live carp, other fish and crayfish that were carried in special 'fish chests' (Gilsen and Kauri 1959). Fish and other animals were packed in a purpose-made box within supported layers of saturated grass and with a trickle system using clean water taken from along the roadside. Fish could remain alive in transit for several days. This was at a time when the spread of carp through land, waterway and sea transfer became more widespread across Asia and northern Europe. It was probably carried out during the cooler Continental early spring months (March/April), when sea travel condition is less stormy and fish transport is less risky in terms of survival. This is also a time when small amphibian eggs and tadpoles and aquatic invertebrates could also have been picked up and carried unintentionally. The re/introduction of fire-bellied toads was also reported from 1830 in Denmark in response to a slight trend in climate 'recovery' that continued until 1850 (see below). The evidence from measured climatic variables and more-restricted habitat availability in countries such as Britain, Denmark and Sweden suggests that in northern Europe several amphibian and reptile species are naturally more vulnerable than others to decline and extinction. This does not make them any more or less valuable per se, but points to a more difficult situation against which conservation efforts can be placed, particularly those of fragmentation/ inbreeding effects caused by isolation. Poor, slightly deteriorating summer weather in Sweden from 1861 to 1930 and in the 1950s is pointed to as causing retreat by that time of fire-bellied toad *Bombina bombina*, natterjack toad *Bufo calamita*, green toad *Bufo viridis* (*Pseudepidalea virdis*) subgroup, spadefoot toad *Pelobates fuscus* and tree frog *Hyla arborea* (Gilsen and Kauri 1959).

Fish and presumably amphibian importation using the transport methods similar to those described above was featured during the monastic and early medieval period and is possibly an ancient practice. An increase from around 1600 was possible as the transport of carp and other fish by boat into Britain gained momentum with demand for food from London's growing urban population.

Gilsen and Kauri (1959) also reported on the distribution of Water Frog in Sweden. The single isolated population based on Kungsangen marshes in Uppsala is unlikely to have been previously missed by the local cluster of early Swedish naturalists and in the absence of an explanation might be considered as likely to be an introduction as to be native. The origins of those isolated on the Uppland coastland and particularly the numerous small islands, is worthy of debate, as are the mammals, reptiles and amphibians of the island of Gotland, some ninety kilometres from the mainland. Water Frog in Finland is considered to be introduced and the origin of a single population in Norway is also debated and hard to prove in terms of its native status. Gilsen and Kauri took a view that the Uppland coast Water Frog was a post-glacial relict. In southern Sweden all of the three main northern European Water Frog types; marsh frog, pool frog and edible frog exist. Prior to the land bridge between Denmark and eastern Britain submerging in the Mesolithic period, there is little reason to suggest that all three types were not present. This is because they had similar distances to recolonize from glacial retreats on both sides of the Rhine and other large rivers in Germany that form geographic barriers to dispersal from the south.

Water Frog bones occur in the fossil record in Britain but have tended to be indeterminate at species level. This is because the fragile head bones that determine species precisely are easily broken unless extraction methods take this into account. This seems not to have happened due to a lack of specific studies to investigate past occupation of Water Frogs. Probably due to cost and a lack of interest, such studies have been the responsibility of the Joint Nature Conservation Committee; a government agency that has had little funding and capacity in this area, despite the serious financial implications of applying interpretations of any evidence.

The water level rise and tsunami of around 8100 BP that are thought to have helped finally sever Britain as an island, occurred at a time immediately prior to maximum post-glacial temperatures some two degrees warmer than those today.

At the time of separation, Britain would have had around 1,000 years of temperatures as warm as or warmer than today, explaining its receptiveness to colonization by species now found in north and central Europe (Ford 1982).

Despite warm periods in the first millennium, around AD 1250 a series of poor summers caused noticeable slow-down in biological processes in Britain, for example grape growing became unviable. There was a fifteen-year stretch of poor summer temperatures in the next century, 1310–1325, with famine in England between the years 1311 and 1317 and again from 1345 to 1348. This is a likely phase (1310–1350) when a number of species that had colonized at the edge of their thermal range and requiring warm summer temperatures contracted in range or became extinct. There were other periods with severe winters that may have also reduced the survival of some species. Amphibians and reptiles found today in northern Europe that could just possibly have hung on until then, if present, could have died out naturally as their tadpoles simply had insufficient warmth to develop fully. This is the time when other native species, found more widely distributed in Britain in the sub/fossil record (sand lizard, smooth snake, natterjack toad), may have contracted in range and habitat preferences and become more confined to 'warmer' sandy soils, as is observed today. This is suggested by the wider distribution of sub-fossil finds of those species. The main period when UK temperature-sensitive species contraction and extinction may have prevailed, the 'Little Ice Age' lasted around 300 years (1550–1850). In some years permanent thick ice formed in the sea off the north Norfolk coast, in Fenland, and across the River Thames (1683–1684). If reptile and amphibian species not present naturally today had survived deteriorating climate in the first millennium, or been introduced and formed small distributions, then this is most likely the time of their final disappearance. Unfortunately, without further field research we will not uncover the true sequence of events and the speculation can only continue.

The retreat of pond terrapin from northern Europe is well documented from archaeological finds indicating presence in Sweden, Demark, Britain and Holland up to around 4,500–5,000 years or so ago. This followed a post-glacial expansion from the southeastern Balkans into Britain, central Europe and Scandinavia. North-eastern Europe was colonized from another refuge further east. Around 5,500 years ago pond terrapin records suddenly terminate in Sweden, some 1,500 years before the Holocene thermal maximum ended in Scandinavia and distinctly earlier than previously thought (Sommer et al. 2009). This extinction coincides with a temporary cooling period during the Holocene thermal maximum and is likely related to lower summer temperatures deteriorating reproductive success of this and probably several other herpetofauna species. Although climatic conditions improved later again, recolonization of Sweden from southern populations was prevented other than by human transfer by the Holocene submergence of the Danish Straits around three thousand years earlier.

Lever's (2009) view that there is a distinct possibility of European pond terrapin becoming established in southern England seems speculative and improbable at present. This is because of the combination of temperature constraints on egg survival, a lack of habitat and the fragmented and often polluted state of the UK wetlands. Equally, global warming may in fact lead to the cooling of UK temperatures within decades. There is no conservation case for the release of this and similar kinds of species for a range of reasons, not least uncertainty over future shift in weather patterns. This may not be accepted by a small group who feel they can argue a case for releasing species of butterfly, reptile, amphibian and mammal secretly or without proper consultation or rationale, and so the possibility of future (illegal) deliberate releases must be considered likely.

APPENDIX 2. Further notes on the taxonomy, distribution and origins of Water Frogs in Britain and the London Area

Taxonomy and general biology

Pool, edible and marsh frog types can be distinguished to a greater degree by their head bone morphology although the degree of overlap leaves some uncertainties (Boehme 1977, Boehme and Gunther 1979). Genetic tests and vocalization/calls (Wycherley 2003*a,b*) offer additional methods. Pool frog and marsh frog are considered by most to be two distinct species. The edible frog is a hybrid (technically a klepton indicated with 'kl.' between the generic and species names) which is a fertile hybrid of these two species. Edible frogs occur when a male pool frog mates with a female marsh frog. Male marsh frogs seem rarely to mate with female pool frogs. In the wild, hybrids tend to occur amongst both parent species and are infertile, often low in number and relatively unsuccessful. With Water Frogs however, the edible frog shows vigour and can maintain itself once established by coexisting with pool frog alone and they are almost always found together. When they mate with each other edible frogs do produce some marsh frog offspring although these are reported to be weak, with a low survival rate. When edible frog mates with pool frog more edible frogs are created. So in theory, at an edible frog colony, both parent species as well as their hybrid may be found although edible frogs may occur in proportions that reflect a range of things such as habitat quality. In rare cases edible frogs can even self-sustain themselves without pool frogs. This makes recording and reporting difficult because breeding edible frogs may well include pool frog and marsh frog, and over time it is possible that in the right habitats an edible frog colony can result in a pool or marsh frog population emerging. With the range of other similar species and hybrids that we now know about, the combinations and outcomes are potentially extremely complicated.

Water or Green Frogs are generally greener and grow larger than the Brown Frog group which includes our native common or grass frog *Rana temporaria*. Their name reflects their residence in or at the edge of water for a much greater period than Brown Frogs. The former are diurnal and like to sunbathe, making a splash when approached by diving at the water's edge.

Water Frogs interbreed and as a group have a massive international range due to their occupation of a wide range of habitats, cannibalistic tendencies and ability to use the land/water interface so effectively. The slightly larger marsh frog is the most aquatic and typically hibernates under water. Marsh frog populations in France and Switzerland are derived from frogs imported and bred for the food trade, marsh frogs being slightly bigger and hence favoured for culinary use.

The marsh frog has a particular and principal competitive advantage over pool and edible frog, in that its tadpoles are unpalatable or less palatable to fish and hence it has a competitive advantage in fish-occupied habitats. They are voracious feeders under water, particularly the marsh frog that also breeds a little earlier in the year, April or May, than pool frog and the hybrid edible frog. Anecdotal observation suggests that in some cases marsh fog populations occur in larger more-open and unvegetated ponds while pool frogs prefer smaller more-vegetated ponds but there is substantial overlap. Generally, edible frogs seem to prefer extreme disturbed habitats typical of quarries and seem to have expanded greatly, exploiting the new habitats resulting from human activities.

Water Frogs are hard to tell apart and they have striped, spotted or plain coloration that is quite variable. Edible frogs almost always have a light-coloured stripe along their back. The Water Frogs are relatively similar looking amphibians and hard to determine exactly other than in the hand and then often not conclusively. Coloration is variable despite broad trends and in truth an animal cannot be exactly recognized without genetic tests. The marsh frog has slightly longer legs and bumpier skin. Smith (1951) indicated that in his experience only a small proportion of marsh frogs had a dorsal stripe, however, this may have changed or been a reflection of his material at the time. Smith also noted how Water Frogs in captivity or in the wild after hibernation and in less-sunny places are browner than those that have basked in the sun which turns them greener. Tadpoles also cannot always easily be distinguished in the field.

A survey in France and northern Spain (Schmeller et al. 2007) has investigated Water Frog populations, looking at twenty-two localities in the Rhone drainage basin and four in the Ebro drainage basin. It was reported that the marsh frog has the ability to replace native species such as Graf's hybrid frog *Rana grafi* and the Iberian Water Frog *Rana perezi* and to dominate. The competitive advantage is related to its ability to cross-breed with other Water Frogs and preferentially to produce more marsh frogs, the ability of female marsh frogs to live longer, and for them to be more fecund and to grow faster.

Marsh frogs seem to prefer larger, deep steeper-sided water bodies. Pool frogs seem to have found a niche in smaller and high-altitude pools that are not dominated by marsh frog. In Britain, Water Frog tadpoles metamorphose after August each year but many do not, due to insufficiently warm temperatures for them to develop fully, pointing to this factor in their persistence. This is most likely to be one of the main limitations to survival and spread along the edge of northern Continental Europe until relatively recent runs of warm years in addition to increased human movements of the species. The warm summers of the late 1980s and 1990s appeared to cause a noticeable increase in Water Frog numbers and spread, as evidenced by reports to common frog spawn telephone 'advice lines' run by London-based charities in the 1980s (TESL, pers. obs.).

Distribution and origins

The story is one of two similar species, expanding their range after the last glaciation. The pool frog appears to have moved north and east from the Adriatic/Mediterranean coast, around the Alps, while the marsh frog has moved north and west from the Caspian Sea/Ponto Mediterranean region. Bones of both species are recorded at Pisede in Germany in archaeology dated to between 5,000 and 7,000 years ago, so presumably they met and may have been interbreeding at or around that time and probably beforehand, inhabiting land masses that from around 6,100 years ago became submerged by land that is now under the North Sea. If both species arrived more or less simultaneously in northern Europe a few thousand years earlier as would be expected, with the marsh frog colonizing east of, or along the Rhine, that used to confluence with the Thames near what is now Dover, then in theory both species would have been present together with their hybrid the edible frog in south-east England/East Anglia.

A similar frog to marsh frog, *Rana perezi,* occurs in Spain and western France and a frog close to pool frog, *Rana bergeri,* occurs in Italy. Pool frog appears to be rare now in pure populations and seems unable to out-compete its hybrid. Pool frogs may appear in edge areas such as mountain ponds as a pure species if it has competitive advantage other than geographic isolation (such as cold tolerance), but this has not been demonstrated. It seems likely that edible frog is effectively for now 'the future' of pool frog and that maintaining isolated pure pool frog populations will only be viable if a large amount of habitat is available for big populations of many thousands and without a probability of proximity of other Water Frogs that would inevitably breed with them.

The discussion over the possible nativeness of Water Frog in Britain rumbles on despite a strange and relatively rapid series of events from the 1990s that culminated, following minimal public consultation, in a declaration by government that pool frog was a recent native species to the UK and of its protection in the wild by law. This was despite scientific challenge to the quality of the supporting research (Burton and Langton 2005, Langton and Burton 2005).

It is known from the ancient fossil record of West Runton in Norfolk 600,000 years ago that at some time in the distant past the area now defined as England was inhabited by a marsh frog-like animal. When sea water rose and split Britain off after the last Ice Age and the climate was warmer than today it seems difficult to argue why one of the two Water Frog species *R. lessonae* and *R. ridibunda* would be present and not the other and most probably with the hybrid. The fossil records in northern Europe prove pool and marsh frogs to be present together around 6,000 years ago. As the waters rose, both pool and marsh frog (with edible frog) could have been present, and should be detectable given adequate archaeological investigation, albeit that there was only a few thousand years before the climate began to drop towards temperatures in which they would struggle to survive. Denmark was a last link of the English coast with the wide open European mainland (Doggerland, now under the North Sea) and today has all of three types. Theoretically in the warmer Iron Age London Area and East Anglia it is hard to imagine why marsh, pool and edible frog would not have been present through the various interactions of humans and animals in natural and disturbed habitats. Once this is accepted, together with the apparent decision not to try to eradicate them, then it seems pointless today to use finite resources to try to prevent their inevitable spread or to try and maintain 'pure' enclaves.

However, some speculation has been that the lack of evidence of Water Frog bones in general in the post-glacial English fossil record indicates that it existed in only remnant numbers, although this only rests on the difficulty in finding intact head bones for accurate identification. The use of leg bones is equivocal (Langton and Burton 2005). The fact remains that there is no legacy of fossil or sub-fossil remains for Water Frogs in Britain after the last Ice Age until relatively recently. What has been found, largely incidentally, is a very few bones that can be attributed to Water Frog from domestic sites only and only after human migration to Britain picked up after the start of the Roman period.

APPENDIX 3. Further notes on claims about Water Frogs and their translocation in England

In London in the 1840s, a newly established magazine *The Zoologist* provided a basis for debate on the subject of the status of Water Frogs in Britain, and over the years the initial claim that it was native to East Anglia were refuted. In 1884, Boulenger commented on the insufficiency of the case by Thomas Bell, who announced that he suddenly remembered that his father had heard something that might have been Water Frog calling in Cambridgeshire in the eighteenth century (Boulenger 1884*a*, *b*). Bell had slipped his assertion into a reprint of his book (Bell 1849) on British herpetofauna, basing it also on the claims of an entomologist Frederick Bond from Kingsbury in Brent (Bond 1844*a*, *b*) who helped establish *The Zoologist* and who appears to have been losing face until Bell decided to back up his argument.

One suspects when reading Wolley's (1847, 1849, 1859) contributions that there is a degree of suspicion towards Bond and his claim. Bond had an ally in the influential Bell, whose other strange claim of the time was to name a new frog for Scotland '*Rana Scotia*' without seeing any specimens, a claim soon withdrawn, and perhaps indicating poor judgement. Bell later failed to find favour with Charles Darwin's research. Bond appears to have declared the finding of a colony of Water Frog similar to those he revealed at Fowlmere in Cambridgeshire, near to his home at Kingsbury in Brent, north London, which was then a rural village. Water Frogs from Fowlmere (that were later described as pool frog) travelled between Cambridgeshire and Epping (see below), organized by Charles Thurnall, a linseed and mustard oil merchant from Duxford. Clearly frogs were being moved around and the possibility of Bond's London Water Frogs having been taken to Fowlmere cannot be ruled out, which may be what Wolley was hinting at in 1847 when he queried their true status. Fowlmere is around ten miles south of Cambridge, the university town where frogs were used in huge numbers for around 200 years for teaching purposes, and this raises some rather obvious and interesting opportunities for archival research. Water Frogs have been released from Cambridge in recent times having been 'spared' dissection, and may have been for as long as they have been used there. Certainly in the 1840s Henry Doubleday moved Water Frogs from Fowlmere for release near to his house in Epping Forest, as reported in *The Zoologist* (Newman 1848). The records around the period of mass importation of Water Frogs to the UK from the late 1830s leaves, as it did at the time, a blur that has not yet been sorted out. However, Boulenger's enquiries showed the difference between the 1830s/1840s edible frog imports and the other localities in East Anglia that he described as Italian *lessonae* (pool) type and of obscure origin. He too found Bond's accounts inconclusive.

If Water Frog was present in Eastern England before the 1830s then, why is there no record as there is in other European countries from or before the seventeenth or eighteenth century? In the mid nineteenth century, John Wolley, finding edible snail *Helix pomatia* at one pool frog site, suggested a link with imported frogs from Roman times and others since have mentioned the probable traffic of frogs into the UK with the carp culture associated with medieval monks and monasteries (e.g., Fitter 1959). If Bond was not responsible for the origin of pool frog at the sites that he reported then others may have done earlier. We are back to the conclusion that only the sub-fossil evidence can truly solve this dilemma, the written accounts so far located are inconclusive (Langton and Burton 2005).

The claim that pool frog in Britain is a recently extinct native species (Beebee et al. 2005) has been recently commented on by John A. Burton (a previous LNHS member and recorder) in terms of it being the 'Piltdown Frog', in as much as most of the specimens date from a time after there were known to be extensive introductions and releases. His extensive research into hoax/fraudlent claims in zoology and botany over many years identifies unusual situations and there are some parallel characteristics in the two cases. In the Piltdown Man case, Charles Dawson actually forged skull bones to suggest an early human species had been discovered. His results were taken in good faith by a range of interested parties in different disciplines who then worked up theories alongside and developed evidence to embellish Dawson's initial find with supporting interpretation. Another example Burton described in an article in The Linnean Society newsletter, which was not deliberate, concerns a single erroneous record of alpine shrew (actually a dark-bellied water shrew), which became embellished over the years to include the whole of the Pyrenees, way outside the species' actual range. With the recent pool frog bone descriptions, the identification was taken in good faith by generalists for several years until the nature of their uncertain identification was revealed. Those producing supporting evidence to the pool frog bone claim individually had or developed circumstantial cases with supporting evidence. As with the Piltdown case, if the initial bone evidence cannot be trusted, any consequential theories simply remain inconclusive.

APPENDIX 4. Further notes on American bullfrog control in the London Area

On the outer edge of the London Area in 1999, the Environment Agency and Froglife, together with a concerned landowner, located America bullfrog *Rana catesbeiana* tadpoles and metamorphs in large numbers at two ponds on farmland at a site around five kilometres south of Edenbridge on the Kent/Sussex border (Banks et al. 2000). Two small fly-fishing lakes, one discharging into the other, were located together, one of which also had a small shallow side pond. The specialist aquatic management team from the Peterborough office of Herpetofauna Consultants International (HCI Ltd) were deployed with financial support from English Nature under the direction of Brian Banks. Amphibian drift fencing and pitfall traps were placed in the autumn of 1999 to minimize the dispersal of bullfrogs away from the lake during draining down to remove them using screened pumping techniques. English Nature also commissioned HCI to do field work in 1999 and in 2000 to try to establish the extent of any bullfrog distribution in sites around the original source ponds, and to trap further bullfrogs.

The origin of the bullfrogs, later found to be accompanied by African clawed frog *Xenopus laevis* was thought to be linked to Blades Biological Supplies nearby where the owner kept and bred bullfrogs and African clawed frogs to sell as biological specimens. Reports of the escape of 'a bullfrog called George' around the mid 1990s pre-dated the shooting of a 'large noisy frog' on one of the ponds in 1996/7.

After draining and removal of thousands of tadpoles and froglets in 1999, survey work in spring 2000 made it clear that immature bullfrogs at up to 65 mm body length had dispersed to a number of water bodies around the original breeding ponds and that other adults were in the area. Twenty-three ponds were identified within a one-kilometre search area and visited to check for the presence of bullfrogs. A further 108 sub-adult bullfrogs were located in 2000 and removed from the original ponds and four others of twenty-three checked, all additional ponds occupied being within 500 metres of the original breeding pond. The few remaining immature froglets around the original breeding ponds reached 110 mm body length by summer 2000 while at newly colonized ponds, body size was only up to 75 mm.

In 2001 all ponds were visited every three to seven days, May to August, to determine numbers of bullfrogs visible, to check for adult male calling activity and for signs of spawning. This was not ideal but cost constraints prevented the visiting of all of the ponds every three days, including night visits. Further culling of residual numbers by landowners in 2001 was monitored with thirty-two immature bullfrogs being taken. Observations by day and night in 2001 suggested that numbers of adults in the area were at or close to nil at the four remaining ponds where they had been seen in 2000 and 2001. In late summer 2001 however, to disappointment, bullfrog tadpoles were again found in the original 1999 emergence site. After fencing the ponds again, over 1,000 tadpoles and froglets were removed over winter 2002/03.

The draining down following the prior rescue of rainbow trout *Oncorhynchus mykiss* and tench *Tinca tinca,* was again achieved through pumping and with use of seine and hand nets by the Environment Agency. The narcotic/anaesthetic rotenone was used to ensure all froglets were removed. No adults were found. In January 2003 the adjoining lake was netted and checked with scuba diver search by Kevin Morgan but no tadpoles were found.

During 2002, in ponds in the general vicinity to the initial breeding, seven more bullfrogs were culled and checks for calling males and spawn were reduced to every week to ten days. One or two adults were seen at two large ponds near to the initial breeding site but low numbers made catching/culling opportunities very stretched. In autumn 2003 bullfrog tadpoles and froglets were found in another pond about 300 metres to the north suggesting a post-1999 breeding, and spawn that was missed by the monitoring checks, possibly due to their infrequency or because bullfrogs sometimes lay eggs below the surface on vegetation that are not visible from the bank without a high-power torch. In some cases a boat is needed to get close enough to find it but government resources were insufficient to cover such proactive (as opposed to responsive) effort. These ponds were also fenced off and pumped. In September and October 2003, 2,731 tadpoles/froglets were removed from 'carp' pond and seventy-nine from the 'Weedy' pond. To everyone's astonishment, 350 *Xenopus laevis* tadpoles and one adult were also found and removed and a further albino adult was found around 2005.

Of the few bullfrogs reported by pond owners at the more dispersed sites (two ponds with up to five sightings) most could not be found during inspections, and over time, herons were considered to have predated several or possibly all, apart from three that were caught or killed by owners. In total there were eight ponds with confirmed bullfrog presence, and a wider sweep of around fifty ponds followed in later checks.

American bullfrog tadpoles take three or four years to mature and this is an important factor in the ability to control their numbers. However, the solitary and territorial nature of adults appears to make it hard to locate and remove every single individual, as might generally be expected with amphibians. Equally, the aquatic habitats comprise relatively small ponds. In a larger lake or similar waterway situation control measures would be more difficult and expensive because drainage, fencing, netting and culling might be difficult or impossible without great expense.

More recently from this site the fungal disease chytridiomycosis (Longcore and Pessier 1999) was identified by the Institute of Zoology, London in both American bullfrog and common toad *Bufo bufo*. This suggests that pathogen transmission has occurred as the result of non-native species release/escape into the wild.

Book review

A new atlas of the Kent flora. Eric G. Philp. Kent Field Club. 2010. A4 hardback, glossy cover, 348 pp. £39.50 + p. & p. From Kent Field Club, Brogdale Farm, Brogdale Road, Faversham, Kent ME13 8XZ. ISBN 978 0 9561926 2 2.

This book is a remarkable achievement, being almost entirely the work of one man in the twenty years from 1991 to 2010. Kent is only the second county to have been the subject of a second atlas flora (Hertfordshire was the first). Eric Philp wrote the first *Atlas of the Kent flora,* published in 1982, and now he is the author of the new one.

How does this new volume differ from the last? It is more up-to-date, of course, but it is also more comprehensive. It is also more attractive, having colour on almost every page (including some fine plant portraits and evocative landscapes, but with no obvious criteria for their choice) whereas the 1982 atlas had no colour. The first atlas flora, though written by one man, resulted from the recording effort of a team of botanists (180 helpers are listed) who made 265,511 records; the new book is almost entirely the work of Eric Philp who has made over 250,000 records himself (whilst acknowledging particular help with the brambles, hawkweeds, docks and willowherbs, and listing eighty helpers).

Mapping is on a tetrad basis as it was for the first atlas flora. There are 1,043 tetrads in the survey area which is the administrative county of Kent together with the now separate unitary authority of Medway. That part of vice-county 16 West Kent which is in the area of the Greater London Authority is not included on the grounds that it was adequately recorded in the *Flora of the London Area* published by the LNHS (Burton 1983).

Short introductory sections locate the county in the British Isles, define the survey area and describe the geology and weather and the methodology and results of recording from 1991 to 2005. The bulk of the book comprises brief descriptions of the status of all species of vascular plant ever found wild in Kent (including comparative figures for tetrads in each survey period) together with distribution maps for all but the rarest species found during the survey period. Following the example of *A flora of Norfolk* (Beckett et al. 1999) selected maps have coloured background layers demonstrating the significance of woodland, rivers, water bodies generally, urban areas and main roads, and underlying geology for the distribution of certain species. Three examples are mind-your-own-business *Soleirola soleirolii* largely in or close to urban areas, hare's-foot clover *Trifolium arvense* restricted to the sandy soils of the Folkestone Beds, the Eocene Sands and the shingle, blown sand and shell sand around Sandwich and Dungeness/Romney Marsh, and Danish scurveygrass *Cochlearia danica* on sandy and shingle coasts and along the major roads of the county (in the last case showing a huge increase in distribution from 17 tetrads to 209).

Other plants which have expanded their range include narrow-leaved ragwort *Senecio inaequidens* (1 to 15 tetrads), sea mayweed *Tripleurospermum maritimum* (29 to 84, a case of more accurate recording?), Guernsey fleabane *Conyza sumatrensis* (0 to 218) and lizard orchid *Himantoglossum hircinum* (6 to 17).

There has been no change for many of the most common species, at least two of which were found in exactly the same number of squares in each survey period: ribwort plantain *Plantago lanceolata* (1,031) and common nettle *Urtica dioica* (1,032). It is pleasing to learn that several of the nationally rare plant species for which Kent is important appear to be holding their own. Examples include the late spider-orchid *Ophrys fuciflora* (9 to 10 tetrads), early spider-orchid *O. sphegodes* (16 to 21) and lady orchid *Orchis purpurea* (48 to 44).

The distribution of many species has declined (or appears to have done). In some cases there are obvious reasons. Wool-shoddy is no longer used on market garden crops or in hop-gardens so the associated non-native weed species have disappeared from the Kent flora. A similar loss has arisen from a change in the management of rubbish tips: as they are now continually covered with soil the casual plants that used to be found are no longer. Another is that as waste from the vegetable oil-milling industry is no longer deposited in the county the associated interesting plants are also gone. Apart from these very specific examples the general reason for the decline of species is loss of habitat. The author relates this to population increase during the twentieth century (which continues) and the consequent demand for more houses and related infrastructure to be built. He does not discuss the effects of changes in agricultural and forestry practices, the management of roadside verges or public open spaces or the fashion for tidiness in urban and suburban areas.

Brief reference is made to two major surveys of wildlife habitats conducted in Kent in the last twenty years, but there is no attempt to relate their findings to the author's findings about plant distribution. This is disappointing, but would probably have lengthened the period between the end of the survey and publication of the book.

Commendably, the author has attempted to ensure that voucher material for all the species recorded in Kent is housed in the herbarium of Maidstone Museum. He emphasizes the value, scientific and historical, of this material and the importance of its being maintained for future consultation.

The author is justifiably proud of his achievement but this reviewer can't help thinking that a team of recorders would have achieved better coverage, particularly of non-native species in urban environments. Despite this reservation this is a significant expression of the (more or less current) state of distribution of flowering plants and ferns in administrative Kent and an essential purchase for anyone interested in the flora of the county.

References

BECKETT, G., BULL, A. and STEVENSON, R. 1999. *A flora of Norfolk*. Gillian Beckett.
BURTON, R.M. 1983. *Flora of the London Area*. London Natural History Society.
PHILP, E.G. 1982. *Atlas of the Kent flora*. Kent Field Club.

John Swindells

On the distribution, ecology and management of non-native reptiles and amphibians in the London Area.

Part 2. Disease impacts, perspectives, trade exploitation and finding ethical solutions

TOM E. S. LANGTON
Triton House, Bramfield, Halesworth, Suffolk IP19 9AE

CLIVE HERBERT
67a Ridgeway Avenue, East Barnet, Hertfordshire EN4 8TL

Abstract.......... 157
Introduction.......... 157
Impacts of disease.......... 159
Perspectives on non-native species.......... 160
Better management of trading and home-keeping.......... 162
Ethical solutions.......... 165
Final thoughts.......... 169
Acknowledgements.......... 171
References.......... 171
Appendix. The freshwater terrapin and turtle trade, and
rehoming problems — a case history.......... 172

Abstract

The release of non-native herpetofauna, together with associated pathogens appears to be increasing. Since 1990 awareness has grown to the threat that new or latent pathogens and diseases can hold for native species. The problem is the result of their sale as pets and for laboratory use and irresponsible release. Abandonments have been a consequence of a lack of educational instruction and enforcement of legislation aimed at promoting animal welfare and nature conservation. For some time the government duty, that is also required by the CITES International Convention better to inform the public and to discourage abandonment has been grossly ineffective. There has also been inadequate effort by national government and non-government organizations to establish and promote good standards in the pet trade, home-keeping and in rehoming of amphibians and reptiles. Some confusion with negative effects of non-natives is linked to unscientific reasoning. The bulk of irresponsible trading to the uninformed public is based upon highly exploitative large-volume sales with very low survival rates. Ethical issues relating to poor survival and ill treatment by the public and rehoming issues are described with examples. Aspects of pet keeping and trade exploitation, including nature conservation and welfare issues are reviewed including ways to reduce and to try to end the growth of non-native species and pathogen abandonment.

Introduction

Worldwide, the extent of impact of invasive amphibians and reptiles is becoming better documented (Lever 2003, Kraus 2009). There has been an all too slow realization of the change and harm that non-native species release, interacting with other major forces such as habitat destruction, can bring to both ecosystems and economies. Across the world, the cost of trying to control the harm caused by the international transport and exploitation of wild and some captive reared/bred animals sufficiently are escalating. As damage minimization becomes increasingly important there is need for a range of widely adopted policies and practices to regulate exploitation and to revolutionize our approach to managing wild animals. The first advice sheet on non-native herpetofauna in Britain was produced by the charity Froglife, with support from the Environment Agency (Froglife 1997) on managing exotic species in the wild. A national policy defining native herpetofauna was also a voluntary sector initiative, being approved by Herpetofauna Groups of Britain and Ireland (HGBI 1996).

Recently in Britain, a national strategy has been established by government to try to begin to document non-native species impacts. These impacts collectively cost the UK economy an estimated £1.7 billion per year (Non-native Species Secretariat Website 2011 www.nonnativespecies.org). The cost of what may be irreversible change to species and habitats can be hard to assess technically without greater research. The NNSS now has responsibility for helping to coordinate information relating to invasive non-native species and has a website to assist those interested in and working on this subject. This involves a method to try to categorize the level of relative economic and ecological threat from species.

To date (mid 2011) NNSS information sheets called Risk Assessments, that attempt to describe impact and threat levels of invasive non-natives have been prepared for herpetofauna, including red-eared terrapin *Trachemys scripta elegans*, American bullfrog *Rana catesbeiana/Lithobates catesbeianus,* African clawed frog *Xenopus laevis* and Italian crested newt *Triturus carnifex*. A number of others are under preparation. Concern has grown about the impact of these species both from their direct interaction with native species and also from potential pathogenic organisms, e.g., protozoan, bacterial, viral or fungal disease. The impact of disease transfer in wild animals, bar the better known and devastating ones as an emerging problem (Cunningham 1996) adds great additional weight to old and often unheeded calls not to allow the proliferation of international trade in wild animals. Exploitation continues to develop under its own momentum in place of an accessible yet tightly regulated and heavily monitored trade. Modern trade should recognize that animals are not just standard commodities. Their exploitation should be based upon the reverse listing of suitable species on nature conservation and welfare grounds, with competence-related licensing to promote good standards. The impact of continued importation of exotic herpetofauna was predicted to be high-risk in respect of disease transfer (Cunningham and Langton 1997) and this has proved to be correct. Further concerns have grown about animal welfare issues from the illegal dumping of unwanted captive amphibians and reptiles due to factors such as stress, starvation and hypothermia, sometimes in combination with disease and other problems associated with an animal being placed in unfamiliar climate and habitat.

Today there are blatantly insufficient systems in place to prevent the continued invasion of traded or otherwise transferred species, and the movement of animals across continents and into the wild is commonplace. One basic cause is the removal of general trading barriers across nations, such as is seen in the enlarged European Union area. The achievement of sustainable utilization in traded wildlife is highly case-specific and demands flexible feedback mechanisms to retain a high degree of market control. It can also be heavily undermined in practice by trade forces (often unlawful or unethical) that have a deregulatory effect. In practice, sadly, the success stories in the reptile and amphibian trade of all kinds are an exception and represent a tiny contribution to any aspiration to reverse species declines through exploitative management. While the process is a theoretical solution to over-exploitation, it can only function when the market is sufficiently regulated to prevent the forces that undermine it. To create 'fair trade' in this area is difficult or arguably impossible (and has always seemed so since the 1980s) because their commodity and profit value to private traders has been valued more highly by government (even if just by light-touch management) and amazingly has, in effect, been protected with greater care than welfare and nature conservation needs and considerations. Consumer choice is insufficiently discerning as the target purchaser for the bulk trade is not a discerning buyer. After twenty-five years CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora, also known as the Washington Convention) has not induced the form of sensible and caring yet tightly managed regulation that could in theory enable a low-impact exploitative trade to exist.

CITES and interpretations of it within regional regulations and national/state laws is slow and sluggish where rapid fine tuning and micromanagement are needed for it to complement environmental protection. Equally international crime is traditionally difficult to prosecute for a range of reasons, including cost, language barriers and legal complexities. International, and to some extent national wildlife crime detection and prosecution have been pushed further down as a priority since 2001 when the newer obligation of 'terror' crime prevention added to the duties of international and national enforcement agencies, already struggling with the illegal drug and weapon trade, human trafficking, computer crime and other crime growth areas. Our natural world lags behind in the queue for resources to solve world conflicts.

Impacts of disease

In the 1980s, those concerned with and working on disease in herpetofauna were relatively few in number. This is despite the fact that, as a basic ecological process, disease has been a centre-stage driver of community structure, species richness and diversity and hence evolution. A mass outbreak of virulent disease in common frog *Rana temporaria* in London and parts of south-east England in the early 1990s influenced frog numbers that had built up high densities in garden environments over the previous thirty years (Langton 1991). The efforts to initiate a response to disease, that was finally identified as a new virus, was even met by scepticism (Beebee 1996), but the impact of disease transfer from non-native animals has also gained much more interest over the last twenty years and better, quicker and cheaper molecular technologies can be used to investigate. These further reveal that disease is clearly not a fringe factor, something that the international Declining Amphibian Populations Task Force was quick to recognize in issuing hygiene guidelines to fieldworkers.

Disease may be particularly influential, as are the other main forms of mortality upon small, declining, fragmented populations. It can function like predation forces on population numbers, causing significant reduction in small, spatially constrained or stressed populations that may not always be short term. It can cause or contribute to dramatic declines and even extinctions through exacerbating factors such as speeding up inbreeding, that might not happen or that would be slower or recoverable in larger blocks of habitat. The first major investigation of disease in amphibians in the UK, the London-based Frog Mortality Project, identified an iridovirus from the ranavirus family (Cunningham et al. 1996). Previously, amphibians seen dead or alive in various haemorrhagic-reddened states were considered crudely in a catch-all category of 'red leg'. Frog iridovirus origin and spread in the UK in recent decades is not fully understood but is circumstantially linked to the release of non-native species of cold-blooded vertebrates (including fish and chelonians) that carry a very similar type or the same virus. Most of the amphibian species mentioned in this review and particularly Water Frogs are listed as having cytrid fungus or ranavirus infections. These were reported in a review of major disease threats to European amphibians, alongside another category of 'additional pathogens' (Duffas and Cunningham 2010).

Disease in herpetofauna can occur without prior anticipation due to a lack of understanding or awareness of disease potential. In the mid 1990s keepers at London Zoo in Regent's Park, Camden, started to take in from the public small numbers of terrapins that were unwanted pets, keeping them in the Zoo's Pelican

Pool. From an initial group of twenty, numbers grew rapidly to about 180. At such density, many became ill and were infected with the protozoan *Hexamita* that can kill terrapins through immune-suppression. The risk then realized was the spread of *Hexamita* to the bird collection and the outcome was that all of the terrapins were euthanased. Euthanasia of terrapins is expensive. One method that has been frequently used in London begins with an initial injection of a relaxant such as Ketamine. Then the head is cut off and the brain and spine tissue macerated manually (pithing). For a single terrapin this might typically cost over £100 due to the costs of disposal of the animal that has been injected with drugs and then classed as clinical waste for controlled disposal.

Perspectives on non-native species

Richard Fitter first recorded British Herpetological Society (BHS) members releasing amphibians and reptiles in the wild on Hampstead Heath (Fitter 1949). From the 1970s the BHS published accounts of garden keeping and wasteland release of European species, and in addition to members several of its officials were part-time pet traders as well as keepers. The BHS even objected (unsuccessfully) to licensing measures that were brought in to monitor and control the sale of native UK species in 1988. It appointed a Trade Officer who was active in fostering aspects of the trade. The subsequent rapid growth of the current mass market more recently means that such groundwork has been influential in this regard. Its newsletter has taken on criticism of the RSPCA, for example when seeking severely to limit the import of large lizards, venomous snakes and crocodilians. The RSPCA is opposed to the trade in wild animals and to any degree of confinement which is likely to cause distress or suffering to the animals concerned. Research by the RSPCA (2004) demonstrated pet shops to be giving very poor advice to prospective purchasers of chelonians. The long-standing activities of London hobbyists in releasing European species in park areas, gardens and on wasteland seem to be associated with a relaxed approach to non-natives, biosecurity and animal welfare.

The most diverse assembly of non-native amphibians and reptiles in Greater London and the London Area in general has been in the Borough of Greenwich, on land in the Kidbrooke area. Here changes to urban land use over about ten hectares of land in the last thirty years or so have included demolition of buildings, road construction, its abandonment to vegetative overgrowth with some management and pond creation. Kidbrooke Green and Birdbrook Road Nature Reserve, together with adjoining garden areas, became effectively a focus for the experimental establishment of non-native European amphibians and reptiles. The site is well documented by Charles Snell in articles in the British Herpetological Society (BHS) *Bulletin* and in technical reports relating to road widening. In the late 1970s, edible frog, tree frog, yellow-bellied toad and wall lizard and possibly other species were established. Interchange of these and other species had occurred with adjacent gardens where amphibians and reptiles were released into enclosures in at least two gardens (Snell 1983).

Prior to the ban on release of non-natives in 1981 when such actions became unlawful, there was quite a strong movement within the BHS, if not to encourage then to try to protect the rights of the public to keep non-native European species in gardens (legally now 'the wild' unless escape-proof) and to tolerate and even to protect them if they spread into the wild. By 1993 (BHSCC 1993) the species that were also reported as present over one or more of the Birdbrook/Kidbrooke areas included pool frog, Alpine newt, marbled newt, parsley frog and sand lizard (sand lizard apparently of German origin). Ponds and wet areas were made for wildlife under the care of the Greenwich Nature Conservation Society, initially as part of compensatory measures for loss of half of the area known as Kidbrooke Green to road works. Some local interests promoted a non-native species centre being built on part of the area. A twenty-four-foot pond was dug by Friends of the Earth volunteers on what was then called the Birdbrook 'Telecom' site, to replace one that had apparently been previously destroyed, to increase the traffic capacity of the adjoining A2 road. It was reported that the London Wildlife Trust and others wished to build reptile and amphibian enclosures and a captive breeding centre on a part of the site to act as a pool to colonize other sites (Snell 1981). Concerns raised by LWT to the Greater London Council and Fauna and Flora Preservation Society were that they wished only to maintain it for the native species, including the great crested newt *Triturus cristatus* which had remarkably appeared with subsequently the Italian version and possibly hybrids. By the 1990s tree frogs were being reported as being 'stolen', and possibly other species, probably due to repeated publicity for the site location, the long-known stimulus for collectors to descend.

One London-based frog breeder, who had lived in Sweden for periods in the 1980s, collected Water Frogs in Sweden and imported them in 1995 where they were bred in confinement in 1996. This was at around the time a Water Frog apparently collected from Thompson Common in Norfolk (where frogs were collected and possibly released unknown to the Norfolk Wildlife Trust managing the reserve by 'visits from herpetologists from London' in the 1980s) was being bred with Water Frogs that had previously somehow also been brought into Britain from Sweden, allegedly 'unofficially' in respect of government permissions for taking and international transport. These are probably not the same frogs that found themselves in the wild in Kidbrooke. However, it does seem that some of the various crosses of them with 'Water Frogs from Thompson Common' have been established at a location near Colchester. No clear account of this important background information was published by English Nature, perhaps because of the lack of clarity of the provenance of specimens and because the messy situation might reflect badly on the credibility of their scientific case regarding the historic status of pool frog.

This was a time when English Nature apparently felt that it badly needed some good news in herpetofauna conservation, if nothing else as some have suggested for other species, a 'PR' exercise in the light of the continued decline in the wild of most amphibians and reptiles and with the rarest species remaining in trouble; leathery turtle dying in UK fishing gear and diminishing in the Atlantic, great crested newt breeding sites in continued rapid decline, natterjack toad struggling in isolated inbreeding enclaves. The more-widespread species were largely neglected and heathland herps sites under continuing pressure despite some localized progress. Such a good news story might allow it to be seen to be successful at least in some respects while the big picture was looking bleak.

Releases of amphibian and reptile species into the UK wild from mainland Europe created debate in the 1970s and 1980s. Due to their geographic proximity, many of these species were extensively supplied in the pet trade in the 1960s and 1970s and also brought home from holidays in a period where few trade or transport restrictions were in place or effective.

At the time, many people on the BHS conservation committee felt that the 'pet trade' exploitation aspect was unsustainable and to some extent unethical, with most purchasers being poorly advised or informed and unable to offer suitable housing or care. The more obvious cruel aspects of the bulk tortoise trade resulted in RSPCA action and the early ban. More widely, as numbers and variety of available species increased in the 1970s, non-native herpetofauna became a novelty alternative to more traditional pet slow-worm, grass snake, and sand lizard or amphibian species collected for UK pet shop sale. Only a few children and enthusiasts had the real dedication and interest to keep them properly. Many escaped and died under floorboards or were also released in unsuitable places. In several instances however colonies established and in a few cases such as the Water Frogs and midwife toad were seen to establish and spread.

With respect to European species however, Trevor Beebee went as far as lampooning the Nature Conservancy Council and the Wildlife and Countryside Bill in the BHS *Bulletin* (Beebee 1981) for listing northern European amphibian and reptile species on a Schedule making it unlawful to release them into the wild. In the BHS Conservation Committee report for 1980 he further wrote that he personally felt so strongly about it that on behalf of the committee he had pressed [government] to remove restrictions on edible frog, marsh frog and European tree frog, Alpine newt, yellow-bellied toad, midwife toad, wall lizard and European pond tortoise from laws to prohibit release in the wild (Beebee 1980). This was done 'since legislation to prevent or license casual release of these harmless species into garden ponds, etc. seems both unnecessary and unenforceable'. The inclusion of this statement in the report was a surprise to those members of the BHSCC at the time who had not been consulted.

In 1981, in response to the impending restrictions on the release of non-native herpetofauna in Britain by the Wildlife and Countryside Act 1981, Trevor Beebee wrote again in the BHS *Bulletin* 'Though personally not in favour of introduction of non-European exotic species, there are some forms just across the Channel which do well in garden ponds and which I see no reason to discourage. I and no doubt many others, have successfully established thriving colonies of both edible frogs and Alpine newts, and quite probably there are other suitable candidates too. In my view since those species from Europe which are likely to be able to establish themselves in Britain are almost always from areas where our own native species also occur, destructive competition is improbable and our fauna is a little richer as a result'.

Continuing in the same way as an aside in his book on natterjack toad (Beebee 1983) commented 'With some species that have obvious capacities to become pests . . . cautious approach is readily justifiable. It seems rather less sensible with amphibians, though, as they are most unlikely to cause a nuisance to anybody or to have serious consequences for species already living in the sites to which they are moved. For example, the introduction of the marsh frog into England in 1935 has resulted in the establishment of several colonies; early fears that it would be detrimental to our native wildlife seem to have been groundless, and the British fauna is now a little richer in terms of amphibians than it was at the start of the century.'

Another BHS member was giving out signals in the 1980s that worried those wishing to have a far more cautious and clear-cut position on the trade and releasing of non-native species. John Buckley (1986), in 'Water Frogs in Norfolk' commented 'There has been some change in the available evidence during the last hundred years but nothing sufficient to cause us to alter his (Boulenger's) conclusion that they (Water Frogs) are not indigenous.' [Note this is a view that JB then changed, and] 'The species of Water Frog already established in the county (marsh, edible and pool) serve to enhance the county's native fauna and their continued existence should surely be encouraged.' Thus Buckley, and effectively the Society, appeared to reflect the views of Beebee and a few dozen UK hobby breeders and dealers on this issue, suggesting that release of some non-natives should not be restricted in the wild. The exact relationship between this confusion and a period of major escalation of the abandonment problem is hard to determine.

Better management of trading and home-keeping

The trade in wild animals as pets in London and in Britain in general has opened up over the last twenty years in a manner that leaves the concerns that were expressed towards escalating international trade in the 1980s (e.g., Warwick 1990) a modest understatement. The outcome from relaxing European Union internal border controls in the 1990s, with faster more affordable international transport of people and goods, internet marketing, supply methods and quick electronic payment systems has been to enable increased access to exotic animals both legally and illegally supplied. At the bulk end of the market, this has reached levels of excess with the availability of some reptiles now as little more than cheap disposable toys for children in a manner not dissimilar to that of the 1950s and still prevalent today in the reduced but still practiced use of goldfish in fairgrounds. Some traders even have a term for the cheaper reptiles included with more valuable species in imported consignments as 'rubbish'. Tackling this issue is difficult because no organization has taken up a full and meaningful interest in the problems. Those most aware are involved somehow in the trade yet unwilling to do anything that might 'put the brakes on'. The industry has no effective representatives and appears at least interested in playing the very old record that claims that animal rights extremists are attacking some kind of human right to keep pet reptiles. The fact is that the trade is too fragmented and fluid to have an opinion. Any shift to regulation is to be resisted because without a mass trade reptile pet shops could not operate. Equally, moderate policy would see every child having the opportunity to study reptiles in the wild and in captivity, at least for the hardy reverse-listed species. Specialists could have licensed access to most species but outside a mass trade-based system.

Such a scenario however is unlikely to play out until all concerned better recognize the sensitivity of reptiles and the high mortality rates that are prevalent and fully take on board the level of responsibility that any wild animal keeper takes on in order to keep it properly. During the mid 1980s, in response to the trend of increase in the casual sale of reptiles and amphibians as pets, Dave Ball of the reptile house at London Zoo instigated a new public display regarding reptiles as pets. This was titled 'Thinking of keeping a reptile — think again', and featured pictures of specialized equipment needed to try to look after them properly. This display lasted for about ten years and may usefully have helped to forewarn many people about the level of expense, time and effort to keep such animals properly as well as perhaps informing those with a keen interest. It included indication of the cost of setting up a vivarium and the research and dedication needed to keep reptiles and amphibians alive. This is one of the few examples of provision of information to the public on how difficult reptile keeping can be, and probably the most important message that most members of the public fail to get before a casual purchase.

Balancing the 'right' of the public to keep animals is a difficult concept when the volume of animals now needed to supply the market and the levels if demand is further stimulated to keep growing. It seems fair to suggest that any such right is accompanied by the right of the animal to be looked after properly and in such a manner that its origin or disposal does not create nature conservation or animal welfare problems up and down the line. Children cannot always make these distinctions and neither can many adults. This is why in the absence of self-regulation that government now at last needs to take a new stance on wildlife trade and in an international as well as domestic context.

Consideration of the basic welfare aspects that might be expected in allowing the keeping of animals adapted to the tropics or subtropics should not go unmentioned, especially in the case of the freshwater turtles and terrapins that are particularly prevalent in London. A case history on the origin and disposal of these species is given in the Appendix because there is a particularly acute problem with chelonians at present. This gives further details showing how serious welfare and nature conservation problems have arisen from a failed rehabilitation scheme that flew unwanted terrapins to a reception centre. This rehabilitation centre for terrapins was compared with Auschwitz in an open letter (Coleman to British Chelonia Group in 2003). Before that however, we present remarks on some aspects of the survival of these species in captivity and in the wild.

Terrapins and turtles that have been abandoned in London's rivers, canals, ponds and lakes are almost always badly compromised right from the start in terms of their health and survival chances. Water temperature is a key factor in terrapin survival, so depth and flow of moving water will be important, as is orientation of basking areas to the sun and extent of tree shade. In some places where temperatures are warmer due to the sheltering effect of the urban environment, and water flushes through a water body to keep it clean and oxygen levels high, it is suspected that terrapins may survive for longer. One such example is the urban Roath Park in Cardiff, which was the site in the UK reported by the National Terrapin Survey to have most terrapins in the 1990s. As a dammed watercourse in origin, it is flushed with water and has a sunny north–south axis. It has an islands area with submerged banks that are structurally suited to terrapin hibernation and shelter.

On release, a terrapin may not have access to suitable food and will not forage when temperatures drop below about sixteen to eighteen degrees Celsius. Terrapins have not been shown to breed unassisted in the wild in northern Europe because temperatures are too low for egg development, although so far there is some evidence of wild breeding in central Germany. To hatch, eggs need to be incubated at around thirty degrees for sixty days which is not possible even in a very hot UK summer. Ultimately the illegal act of abandoning terrapins is animal abuse and needs to be stopped. It has gone on too long and immediate steps need to be taken to prevent further releases.

In captivity, terrapins are not the easiest of pets to maintain, even for experienced specialists. They require a large enclosure, a lot of cleaning, particular food, food supplements and often expensive veterinary treatment. One of the regular problems among captive terrapins is caused by a high protein, low calcium diet which brings on a weak and spongy shell. Shell rot can either be caused by lack of calcium in the diet or lack of sunlight in which the terrapins can bask to synthesize the vitamin D3 which enables them to absorb the calcium in their food. Any one of a number of diseases arising from the relatively cold UK environment can reduce longevity; one of the commonest illnesses is vitamin A deficiency. Vitamin A plays an important part in the production of the epithelial tissues which cover the internal and external surfaces of the body. In terrapins a typical symptom is swollen eyelids. These can fuse together causing the animal to be unable to feed. Infections closely related to pneumonia may result in laboured breathing, discharges from the nose and mouth and swimming difficulty. In care, these need prompt treatment with antibiotics. Basically, the species currently widely in trade should not be sold to the public as they are unsuitable. Terrapins in trade under 100 mm (around four inches) should be banned immediately, as such trade is banned in North America. This should be done as a matter of urgency and such an act would remove from the casual keeper the most unsuitable animals.

Recently there has been a reaction that is a very interesting new development in one group of biologists in the front line and receiving end of these problems. Britain's vets are presented with sick and dying wild exotic animals sold as pets so frequently that in 2010 they considered it one of their major national concerns. It was debated at the British Veterinary Association meeting in 2011 at Regent's Park. Here one key-note speaker and senior veterinarian indicated that training of vets in exotic species at UK's universities and teaching departments was, 'frankly rubbish', and there was a dilemma in the large amount of time that would be needed to train vets to be able to do the job well. At the meeting, in a recorded vote, ninety-five per cent of those attending voted in favour for a complete ban of the trade in wild-caught reptiles and for the majority it would be unconditional. Such powers are beyond their control but if the senior professional group in the subject are prepared to stand up in this manner in such a united way, the message is clear to government on the overdue need for a fresh approach on the mass supply of unsuitable animals to the public.

A few enforcement operations by government Customs officials resulted in fines and custodial sentences for reptile smuggling in the 1980s and early 1990s and since. Although some degree of deterrent, this had little overall effect on volumes entering London and the UK as a whole, probably because detection rate and enforcement action have addressed just a tiny proportion of criminal activity and fines, and penalties were lower than for other illegal trades. Trade has generally become less well controlled since movement of the public and 'commercial goods' within the European Union countries as border controls between nations were relaxed in the early 1990s and less heavily policed. Equally, more-subtle frauds have become more difficult to detect and enforce against.

Ethical solutions

One of the most important points for educationists regarding the management of non-native species issues is not to let public perception somehow demonize wildlife by establishing artificial 'nice' and 'nasty' categories. All concerned must work hard not to let any need to remove or cull animals diminish responsible attitudes towards species in the mind of the general public. This can be difficult when animals appreciated in their native habitat are reduced to 'pest' status in the one that they have invaded and this produces a paradox for animal rights protagonists who support the individual animal, whether it is in or out of its 'evolutionary environment'. That the 'rights' of a released animal and its offspring are compromised by the person releasing it is hard for some to accept, but it is the releaser who creates the paradox.

When animals are removed from the wild and/or culled to reduce measured or suspected damage this should remain a sincere act, done with maximum care and not trivialized. Teaching young people responsible, sympathetic approaches to non-natives control as a last resort is vital. This manifested itself recently to one author (TESL) when children at a local primary school showed him how to kill 'bad' (harlequin) ladybirds to help protect 'nice'(native) ladybirds. The lads in question, in error then squashed a large native ladybird and were, sadly, excited about being encouraged by grown-ups to kill ladybirds. Pest controllers may sometimes develop a mind-set that culled animals are bad and give their worst example to impress their clients. The potential harm of some of the more frequently removed native and naturalized species are often over-emphasized.

It is important to stress that the public should not see bullfrogs, terrapins and similar as bad or frightening as they can sometimes be portrayed. This may happen, as when any story is simplified, offered to the press and 'spun' to create sensationalism. One of our members, Bill Oddie, has made the point that non-natives, even those causing human disease and or economic damage can be attractive and interesting. Such thoughts help to suppress anti-animal rhetoric and to foster understanding and knowledge. This humane approach may seem sentimental and be scorned by some who kill regularly professionally or as a hobby but it does seem the best approach if we are to gain generally sympathetic attitudes that the public can share in. Presented carefully it does not contradict the fact that wildlife management other than in remote wild areas involves controlling the density and distribution of animals and plants. An understanding of killing with compassion and high regard for animal welfare are things that every person should be encouraged to believe in.

Better education of the public on non-natives issues will be a costly mission to sustain and requires careful handling with scientific principles. It requires a shift of emphasis on presentation of the natural world from scariness, deadliness or weirdness from the early years of television and magazines (that is creeping back from the 1960s) in favour of more informative concepts, effectively more public information on important wildlife issues, and a new series on 'threats to the wild' is needed. There is also a need for more of the informed natural 'wonderment' approach that Bill Oddie, Chris Packham and others have developed. There are however challenges, as illustrated by media reports that the BBC1 television programme *Life in Cold Blood* (2008) narrated by David Attenborough was so effective in making people appreciate amphibians and reptiles, that its showing stimulated pet trade sales. Other BBC presentations and those of other channels have been more sensationalist, using animal issues to entertain, sometimes with incorrect or distorted information which may in fact in many cases undermine or undo the good work of other programmes. The TV industry needs to take a good look at this problem and avoid becoming an electronic circus in the future, in the manner of some of the tackier programmes being made (e.g., *I'm a Celebrity*). The care with which wild animal information and messages are put out is increasingly important to the appreciation and protection of wildlife as our communication technology becomes more sophisticated.

More recently the existence of a number of examples of apparently benign wildlife introductions have been offered and a school of thought suggests that always taking a negative view is misleading (Hamilton 2011). Cases have also been made that the impact of plant introductions has been overstated. There may be a number of cases where no obvious harm and some perceived benefit may accrue from introduced species but largely the approach appears borne from a genuine potential to use non-natives in a positive way rather than a denial of the massive harm caused by many species. To be valid it requires a much deeper understanding of subjects such as disease transfer and management and how plant and invertebrate communities are impacted when new species are released.

One apparently benign release is the brown hare *Lepus europaeus,* an old UK introduction that now even has its own government-promoted national conservation target. In Patagonia in South America, on some managed wild areas, brown hares now probably form a significant part of the prey of puma *Felis concolor* and Geoffroy's cat *Leopardus geoffroyi*, where they have partly displaced the mara *Dolichotis patagonum* (a large cavy). But if hares were culled or eradicated it might put the now much smaller mara populations under serious pressure, as they are easier prey. In one area a management decision was taken not to intervene (World Land Trust, pers. comm.). Clearly the reaction of any natural community to a new species may be hard to observe, take time to happen and have minor or major consequences over both short and long periods. These are hard or perhaps impossible to predict and it is difficult to argue that a precautionary approach to avoiding them completely is not by far the best policy.

The optimism in respect to rebuilding badly damaged habitats with species from outside the 'native extent' of any natural habitat however must surely be handled only with extreme care. It may not be a flawed concept for many areas but strict guidelines need drawing to determine how and when biodiversity restoration compromises into the broader concept of constructed communities which are an untested concept. Despite being unproven, 'intelligent' and low chemical/carbon dependency agriculture with animal species a part of the community could well become rapidly more relevant within thirty to fifty years as global climate and weather patterns shift more dramatically and animals and plants shift distribution in response. The irony is that non-native species translocation could soon become essential to delay climate-induced extinctions

— a true sign of how desperate matters are becoming in nature conservation. Any advance approach on rewilding destroyed areas of the world in such a manner would require both stringent internationally accepted rules and monitoring to establish continuity and to prevent abuse. In such a scenario, the danger of arguments that man-made communities are as valuable as natural ones, even if the exceptions can prove the rule, should not be taken out of context to devalue protection of what little natural habitat remains, nor be at the expense of restorable communities. However, the world is full of 'damaged' land that requires remediation and in urgent need of revegetating, not least to help attempts to offset carbon emissions. Keeping the two future approaches separate yet in a complementary form is vital for a future where agricultural production and biodiversity protection work in harmony.

There are specific issues that might benefit from new thinking or at least acceptance of concerns that appear to have been ignored. As an example, in the case of Water Frog this may be the time for a fresh start in order to clear the air. Assuming that government will not spend to eradicate Water Frogs, which in theory could be attempted in most areas given a large amount of effort, under the circumstances it is surely time to accept them as 'here to stay', if indeed they prove able to survive in the long term. The various species and hybrids should continue to spread, moving into northern England and more widely in Wales via dispersal and human transfer over the next fifty years or so. The Norfolk Broads, Fenland and other wetlands will be home to Water Frogs of mixed types and particularly the dominant marsh frog types. The possibility of retaining small enclaves of isolated 'pure' Water Frog species looks rather unlikely because their spread to a genetically robust distribution will bring their downfall as they form contact zones with other species or hybrids. This predictable outcome should have been realized earlier so as to avoid wasted resources.

Something currently missing in invasive species management in London is the adequate provision of public information. This is required by International Convention but it has usually manifested itself as just short leaflets or web pages rather than any significant public information programmes. Research (Part 1) shows that many people have been blatantly caught releasing terrapins and frogs in parks around London. They normally seem unafraid to explain what they are doing as if it is the right thing to and to plead ignorance of the law. The levels of understanding are poor because there is so little information offered in a proactive way and also because people tend to do what they like in the absence of advice and/or unless enforcement is seen to take place. There have been ample opportunities for prosecutions but with the collection of specialist evidence and complex case nature of investigations and prosecutions, nature conservation agencies, police constabularies and Crown Prosecution Service have not prioritized enforcement, even when preparatory work by volunteers has exposed good evidence.

The costs associated with any one case might seem unjustified, but as a result large numbers of people are abandoning animals all over our urban and rural countryside; the current effective 'free for all' needs carefully but rapidly taking in hand. After a public warning, a range of cases need prosecuting together with TV advertising or awareness programmes, so that people realize that abandoning non-native animals is wrong and can lead to a criminal record and other penalties. It is time for the government to alert councils and the police to enforce. Equally, government needs to take steps to ensure that there is a place to take every unwanted animal and for the costs of euthanasia to be available if proper rehoming cannot be achieved. This is in addition to prohibition of certain species and size-limit controls.

Sadly, there has been little regarding the nature of the pet supply and abandonment in London and elsewhere since its apparent increase over the last ten years that gives much hope of things getting any better. The problems observed in the 1980s are as prevalent as ever and in particular with respect to infectious disease transmission. Species come and go in trade over a very short period (Tapley et al. 2011) with novelty value for the 'consumer' shifting and pathogens capable of moving to native species being transported around the world and abandoned in the wild with their host. It was realized by conservation bodies in the 1980s that harvesting of wild animals for the pet trade was going to be very difficult as a sustainable approach. This is due to the volatility of the market place and lack of an environment to enable fair trade. In the early experiments with captive breeding in northern Europe, economic forces were soon at play, reducing the value of animals mass-produced by dedicated breeders. As with ethically sourced food supplies, with fair prices for producers, the entire market chain would have to support and protect such sources for it to work. This is not going to happen unless interested parties (collectors, wholesalers, middlemen, dealers and customers) can create it. Commercial ranching and farming to create both nature conservation and commercial gain has only been shown to operate in any sense in a commercial way for crocodilians and in a few other cases. It will not occur when the average purchaser is a harassed parent, impulse buying for a child an animal that will probably only live for a few months. It will not happen while the use of wild animals as pets is considered a normal type of commercial trade. There would need to be a sea change in global perceptions to make sustainable exploitation work in practice and that has never been likely, yet is needed to avoid continued and escalating problems.

It is now interesting to see the desperate proposals to tackle the problems as they become more obvious for all to realize. One includes proposals for the application of a special taxation system with monies transferred to some form of complex local control system that will constrain release of non-natives and enforce voluntary codes of practice (Perry and Farmer 2011). The international trade systems just do not operate to enable such methods and in fact work against them. The suggested mechanisms appear naïve for the kind of world that has developed. It is time to recognize that insufficient work has been done and insufficient measures put in place to apply sustainable use to the wild animal pet trade. If the public and scientific community have not demanded it then governments must legislate toughly. This should include reverse listing (allowing trade only in species judged highly suitable for captivity) and enforce heavily on unlawful activities. Such tough revisions would actually be in the best interest of nature conservation, welfare and pet keeping if genuinely informed and truly representative officials from relevant bodies made serious efforts to support them.

There is, however, a real danger of a dichotomy between those who would see the mass pet trade continue and research it and those who want to see a fresh approach with far tighter controls. Is it acceptable to talk down moves to bring about greater trade control, involving wider bans as unenforceable and to talk of a day when some form of 'best practice' will bring sufficient solutions ? This is a highly unlikely expectation other than with a few local demonstration cases. As CITES has not been able to deliver sustainable approaches then there is a need for a new convention or specific measures in existing ones, with the consequential national/economic zones enforcing legislation. To call for more research and just to hope for the best is asking for trouble at this unstable stage in species exploitation and extinction. More-determined administrative action is the priority. This is a test of human ability to manage one aspect of our rapidly deteriorating world.

There should be no confusion however that bans are sought for non-pet scientific and educational purposes. These require a supply system to be designed without exploitative loopholes and unhelpful leakage between the pet, zoo, food and science industries. If the pet industry problems in all their facets cannot however be controlled they must be dramatically shrunk. It would be no bad thing for people to gain basic and advanced training qualifications before being allowed access to sell or keep non-native wild animals, much as people who handle protected species as volunteers or professionals must invest time and energy in knowing how to trap and handle them properly.

Final thoughts

We have reviewed the occurrence of non-native species of amphibians and reptiles in the London Area. Importation of terrapins, along with snakes and lizards has visibly expanded since 2007. Introduced and escaped exotic animal and plant species are now an increasingly debated issue in recent years in the UK. Issues raised often relate to science (are we sure about the facts?), nature conservation (how should we manage them/the situation?) and moral issues and welfare considerations (is the suffering they cause/endure acceptable/preventable?). Modern environmental teaching may encourage us not to confuse conservation and moral/welfare issues, but with the best available information, in the real world decisions must be made using an understanding of the needs and sometimes conflicting demands from these separate yet interwoven fields. The modern naturalist and conservationist needs to understand both and be involved in seeking practical intervention. Clear reasoning with well-produced policies and practices are needed to prevent confusion, misinformation and wasted resources.

Such is the way with London's exotic herpetofauna. This review shows how the natural history observation and other scientific approaches to various issues remain the guiding lights and how careful judgement must be applied 'in the field'. It shows in often incredible circumstances how some of the matters touch on fine philosophical approaches and perceptions towards exotic species issues.

Of perhaps greatest importance is people taking responsibility for actions relating to the various species concerned to bring about further research, to progress taking action against those continuing to abandon exotics in the wild, to teach people to be more responsible or to try to get government to take more concerted action. This applies at all levels, from the public to government administrators. There is clearly a need to limit (by licensing or other control mechanisms) the importation of species and sale as 'impulse buy' pets, to help to reduce the existing and potential nature conservation and welfare problems.

This review touches on a remarkable range of events, some nearly 200 years ago and some from the last two decades, that illuminate human relationships with wild animals. The complexities of attitudes towards the naturalness of communities and the revisionist debates concerning how we view and manage nature both within our urban green space and more distant wilder and remoter habitats are a reminder of the need for better and more prescriptive approaches.

With current alarm bells ringing over accelerated global climate change, we have experienced, in recent decades, a weather sequence that implies that we are in a short-term warming period that bucks the trend of gradual cooling of our climate since the Iron Age. If we are close to a major tipping point as some models suggest, that then quite rapidly sends UK climate into hotter (but possibly colder or possibly hot and then cold) or more extreme patterns in relatively quick succession, many aspirations will become immaterial. Tinkering by humankind will simply reflect its inability, despite technical innovation, to have managed our wider environment, species and habitats effectively for the benefit of humans and wildlife. An ending to activities that bring on diminished conditions for wildlife could be relatively straightforward, given political inspiration and wise government. As Gerald Durrell put it, 'We are only trying to prevent the human race from committing suicide'. The sensitivity of reptiles and amphibians is a reminder that temperatures control biological processes and that across narrow thresholds, small fluctuations can bring profound change.

Over the years, factors contributing to uncertainty in this area have included contradictory advice from perceived authorities, with actions by individual government officials appearing maverick in approach for unclear or suspected political reasons. Strange positions have been cause-arguing inconclusive science regarding what constitutes a non-native and what should be released. Also unhelpful has been the lack of proper policies, backed by expert agency capacity for rapid review and concerted nature conservation lead action in import control and educational exercises. Ultimately, a body is needed with direct control over the specialist work that may require real expertise and resources. Non-native herpetofauna in the London Area provides a useful microcosm to show how there is need for much clearer and accountable approaches in the future if a coherent response to the problems that are described is to be ready in the planning of 'what happens next'.

We must learn from events such as the removal of terrapins from Sheepwash Pond in Barnet where media reporting simply added to the confusion (Anon 2005, Galbinski 2005, Wallman 2005, Zachariou 2004). Despite some sound comment from the London Wildlife Trust (Cohen 2004), the average member of the public would have been left in the dark with respect to proper information on the incidence of non-natives at this important local nature reserve area.

Attitudes towards the live wild animal trade and potential conflicts between sustainability theories and the reality of impact of commercial exploitation also require re-examination. Will people continue to accept the premature death from neglect of large numbers of herps in addition to fish species that retain wild behaviour in captivity, on the basis that a very small number may care about it? Is casual possession of a huge range of wild animals by the public with no distinction for serious keepers healthy when there is an overwhelming need for better appreciation of their demise in the wild?

Over twenty years ago in an article on the pet trade, Langton (1989) wrote in a European context 'Pet keeping clubs and societies might benefit from considering how to enforce standards and codes of practice in their discipline. They must make the pet trade industries the champions of correct exploitation. This would demonstrate responsibility and assist legislators with the difficult task of designing suitable control mechanisms for trade. This in turn will speed a better application of the science and the rewards of successful wildlife management.' However, in respect of terrapins and freshwater turtles, one of the two focuses of this review, as one chelonian hobbyist consulted put it recently: 'What the hobby is guilty of is abject indifference and apathy. Coupled to that, the two leading chelonian societies are to all intents and purposes, wholly dysfunctional on this subject.'

To go into more-extended conclusions and recommendations on the problems of and plight of non-native herpetofauna is beyond the scope of this review. It is hoped that it gives information that will stimulate further considerations and practical improvements to the current situation. It seems unlikely that without significant government intervention there will be any change to both the releasing of non-natives by the public or relief of the welfare concerns surrounding the main focus of the controversies; the pet trade. Keeping of pets in principle is an ancient activity from which mankind and animals can benefit. It is not per se under threat, but those involved who do not now take steps to try to change animal trading and keeping into highly refined and responsible practices may well find in default a situation where cruder and less-flexible laws need to be rapidly introduced instead, in order to limit the negative impacts and to create a new order that has failed to emerge from free market forces.

Acknowledgements

Acknowledgements are included with those given in Part 1.

References

References cited but not listed will be found in Part 1.

BEEBEE, T.J.C. 1980. Conservation Committee Annual Report – 1979. *Bull. Br. herpet. Soc.* **1**: 6–8.

BEEBEE, T.J.C. 1981. Wildlife and Countryside Bill: Daft Edition. *Bull. Br. herpet. Soc.* **2**: 10–11.

BEEBEE, T.J.C. 1983. *The natterjack toad.* Oxford University Press.

BEEBEE, T.J.C. 1996. Frog mass mortality: scurrilous disease or panic attack. *Bull. Br. herpet. Soc.* **55**: 15–16.

BRITISH HERPETOLOGICAL SOCIETY CONSERVATION COMMITTEE. 1993. *A2 Kidbrooke Park Road Interchange improvement: A survey of amphibians and aquatic invertebrates at Kidbrooke Green and Birdbrook Road Nature Reserve.* Unpublished report to DH Associates and the Department of Transport.

BUCKLEY, J. 1986. Water Frogs in Norfolk. *Trans. Norfolk Norwich Nat. Soc.* **27**(3): 199–211.

COHEN, C. 2004. Terrapins are a threat to wildlife but they must be protected. *Edgware and Mill Hill Times,* 19 August.

CUNNINGHAM, A. A. 1996. Disease risks of wildlife translocations. *Conserv. Biol.* **10**(2): 349–353.

CUNNINGHAM, A.A., LANGTON, T.E.S., BENNETT, P.M.B., LEWIN, J.F., DRURY, S.E.N., GOUGH, R.E. and MACGREGOR, S.K. 1996. Pathological and microbiological findings from incidents of unusual mortality of the common frog (*Rana temporaria*). *Phil. Trans. R. Soc.: Biol. Sci.* **351**: 1539–1557.

DUFFAS, A. L. J. and CUNNINGHAM, A.A. 2010. Major disease threats to European amphibians. *Herpet. J.* **20**: 117–127.

FROGLIFE. 1997. Exotic Reptiles and Amphibians in the wild. Information and advice on the problems of non-native species in Britain. *Froglife Advice Sheet* No. 8. Froglife, Halesworth.

GALBINSKI, A. 2005. Terrapins to holiday under the Tuscan sun. *Edgware Times*, 4 August.

HAMILTON, G. 2011. Aliens to the rescue. *New Scient.* 15 January: 34–37.

HAWKINS, V. A. 1980. A case of 'red-leg' in tadpoles of the American bullfrog *Rana catesbeiana. Bull. Br. herpet. Soc.* **1**: 36.

HERPETOFAUNA GROUPS OF BRITAIN AND IELAND. 1996. *HGBI policy on exotic (non-native) species released into the wild in Britain and Ireland.* Adopted Edinburgh Feb. 1996, HGBI c/o Froglife, Halesworth.

JACKSON, D.C. 2011. *Life in a shell.* Harvard University Press.

KRAUS, F. 2009. *Alien reptiles and amphibians: a scientific compendium and analysis.* Springer Verlag.

LAIDLAW, R. 2006. *Scales and tails. The welfare and trade of reptiles kept as pets in Canada.* World Society for the Protection of Animals report.

LANGTON, T.E.S. 1989. Cold-blooded companions. *Naturopa. Council of Europe* No. 62: 18–19.

PERRY, G. and FARMER, M. 2011. Reducing the risk of biological invasion by creating incentives for pet sellers and owners to do the right thing. *J. Herpet.* **45**: 134–141.

RSPCA. 2004. *Handle with care. A look at the exotic animal pet trade.* Royal Society for the Prevention of Cruelty to Animals, Horsham.

TAPLEY, B., GRIFFITHS, R.A. and BRIDE, I. 2011. Dynamics of the trade in reptiles and amphibians within the United Kingdom over a ten year period. *Herpet. J.* **21**: 27–34.

VETTER, H. 2006. Hermann's tortoise, Boettger's and Dalmatian tortoises: *Testudo boettgeri, hercegovinensis* and *hermanni. Chelonian Library* **2**. Chimaira.

WALLMAN, J. 2005. Captured, the terror terrapins destined for deportation. *Evening Standard,* 10 August.

WARWICK, C. 1990. *Reptiles — misunderstood, mistreated and mass marketed.* Trust for the Protection of Reptiles. Nower Productions Ltd, Surrey.

WELDON, C., DU PREEZ, L. H., HYATT, A. D., MULLER, R. and SPEARE, R. 2004. Origin of the amphibian chytrid fungus. *Emerging Infectious Diseases* **10** (12): 2100–2105.

ZACHARIOU, C. 2004. Branson's bid to save pond from scourge of the terrapin. *The Press*, 5 August.

APPENDIX

The freshwater terrapin and turtle trade, and rehoming problems — a case history

As elsewhere in the UK and probably the world, pet terrapin sales in London in the late 1980s and early 1990s was prompted by a children's 'Teenage Mutant Ninja Turtles' craze that was created in the USA, initially as a comic strip. It quickly became popular and the name was changed to 'Teenage Mutant Hero Turtles'. The storyline surrounds four terrapins flushed down New York toilets as hatchlings, a fate falling to other pet reptiles according to press reports at the time. It was based in the sewer system where fancifully, the turtles mutate into super-heroes following contact with radioactive waste. They fight the 'forces of evil' and so are overtly positive role models but with aggressive crime-fighting activities and so are attractive to the pre-teen age group, particularly boys. A cartoon version ran from 1987 but it was the first film, launched in 1990 that is thought to have sustained and increased demand for pet terrapins worldwide (Tortoise Trust web site 2010). Only in the United States, where the terrapin is farmed, are export statistics available. Through the 1980s the annual exports of red-ears from the USA amounted to roughly one to two million, and during the first half of the 1990s was approximately three to four million per year. In 1990 three million red-ear hatchlings were exported from the USA. Japan was the biggest market (600,000), followed by France (500,000), Hong Kong (300,000), Spain (300,000), Britain (200,000), and West Germany (100,000), and other countries took smaller numbers.

In 1996, the reported total exports of red-ears from the USA were 7.9 million individuals, of which 2.2 million (twenty-eight per cent) were imported to Europe. Exports appear to have been constant since then and by 2007 most of the nine million reptiles exported each year from the U.S.A. were red-eared sliders (Laidlaw 2007), mostly from intensive production farms in Louisiana. Commercial intensive terrapin breeding farms in the USA usually consist of several artificial ponds each of which can contain up to 13,000 adults.

The UK was importing an estimated 300,000 red-ears by the time of the 1997 European Union ban. After this point, traders replaced red-ears with lookalike species, principally the yellow-bellied slider *Trachmys scripta scripta* alongside a range of other species and hybrids being bred in terrapin ranches and farms. More recently, and notably in China, over 300 million terrapins are captive in a total of around 2,000 commercial centres. A range of Asian and North American freshwater chelonians are being cheaply mass produced. They are imported into the EU in huge quantities and arrive typically through the cold-water fish trade. North American species originating from China include *Trachemys scripta scripta, Trachemys scripta troostii, Pseudemys concinna, Pseudemys nelsoni, Pseudemys peninsularis, Pelodiscus sinensis, Sternotherus odoratus* and *Sternotherus carinatus.*

In the USA today, commercial hunters of wild terrapins who supply replacement breeding stock for USA and Chinese farms are also responsible for collecting up to an estimated 1.5 million adult terrapins per year for export to foreign food markets, principally in the Far East. The USA exports hundreds of thousands of tons of terrapins (red-ear and other species) to China each year, with snapping turtle meat a particularly prized item, and a large female full of eggs is sold at a premium. Terrapin meat can even be found in Tesco supermarkets in China although this is apparently under review. A 2007 ban on collecting terrapins in the 200-mile-long Chesapeake Bay estuary of the north-east USA reflects the increased value of the meat; selling at $20 per pound in China. Terrapin meat is popular amongst the growing immigrant community in New York City and many other cities. In 2007 the last major exporter of red-ears in Louisiana, Concordia Turtle Farm, exported terrapin hatchlings to the value of US$ 6.3 million. Few statistics seem to exist in Britain on the importation of terrapins. In 1985, 1,200 snapping turtles were imported to the UK, possibly for the soup trade. Statistics available from the City of London reception centre at Heathrow show that 4,000 common snapping turtles entered Britain through the airport between 1986 and 1990.

The problem of terrapin collecting in the wild for trade to those countries with high levels of economic growth is a part of the general problem of the unethical international 'bushmeat' trade around the world. It is escalating as food for the growing world population becomes more expensive and new ways to access and 'harvest', or more usually to plunder, wild areas in uncontrolled ways are developed. With many terrapins such as the red-ear taking up to seven years and often more to reach sexual maturity, whole populations can be largely cleared out by collecting and then may take decades or longer for the population to recover. A second collection 'sweep' for large sub-adults can then leave a situation where it may be fifty years or longer for recovery to happen, and with continued lower level taking and other cumulative effects, re-population may never be achieved and localized extinction is quite possible.

Back in London, the freshwater terrapin and turtle abandonment and rehoming issues that result from the trade are worth considering further, in addition to the problems being caused to wild populations by trade for human food. At Moorgate in the City of London from the mid to late 1980s a small-scale 'sanctuary' for abandoned terrapins was established in The Barbican. The Barbican Conservatory is a large, heated, glass-covered roof-garden area on the third floor, with tropical vegetation and pools. This apparently informal arrangement followed Corporation of London park keepers at West Ham Park nursery rehousing a small number of tiny hatchling red-eared terrapins that had been left in a paddling pool by members of the public. This preceded a steady stream of unwanted pet terrapins that were offered to The Barbican, or just left there. Due to a subsequent problem of the public adding terrapins to the pools and the children from the nearby Barbican estate taking them and reselling them at Whitecross Street market, a small purpose-built area was established away from easy interference. There were occasional escapes and deaths and additions of mainly red-eared and yellow-bellied sliders, plus other species and hybrids including a softshell turtle *Pelodiscus* sp. There are currently (July 2011) nine residents while the numbers previously were up to thirty-five individuals. Observations by the gardener that looks after them are that they survive on fish food and will only eat the ornamental fish in the pond that they share, as carrion, when a fish has died. They have however been thought to be responsible for fin biting of ailing fish. The Barbican Conservatory has in effect acted like a London park in receiving unwanted terrapins.

With respect to a further problem associated with trade, that of rehoming, there seems to be yet another extensive set of issues. In 1991 the British Chelonia Group (BCG), a voluntary group particularly involved in aspects of pet tortoise and terrapin keeping in Britain, reported on the increased sale of red-ears from North America. These were sometimes packaged in a small sealed plastic 'bubble' container to 'sell or die' and some countries had banned their importation. At the time it was the Trust for the Protection of Reptiles (TPR) headed by Clifford Warwick that took the lead, calling and actively campaigning for the UK government to ban the large-scale terrapin importations. By the end of 1991 BCG had adopted the position of favouring an import licensing system with a ban on unlimited importation. At a meeting of interested non-government bodies in early 1992 however, not all parties favoured an outright ban. The RSPCA called for more data, and the Association for the Study of Reptiles and Amphibians for a quota system.

With BCG previously taking a role in the rehoming of lost or unwanted tortoises it perhaps seemed natural that they might address the problem of lost or abandoned terrapins. 'Homes for terrapins' was advertised in the BCG *Bulletin* and they were soon reporting being besieged with people wanting to give up their terrapins. BCG started a fund-raising appeal, raising £2,200 in 1992 to assist in the matter and with the specific aim, apparently hardening to the TPR aim of 'bringing an end to the import of these terrapins'. It appears however, that there was no subsequent action to follow the fund-raising pledge through. There were then talks of fund-raising for a new turtle sanctuary in Birmingham. Funds were raised but efforts to liaise with Birmingham City Council to build a terrapin pool at their Nature Centre proved unsuccessful.

In 1996, as the European Union 1997 ban on mass importation of red-eared terrapins to EU countries approached, following agreement with BCG around fifty or so rescued red-ears from both abandoned recaptures and from unwanted pets were sent to Secret World, an animal rescue centre in Somerset. Here they were kept and monitored three days per week by BCG members Paul and Maggie Coleman, alongside Secret World staff at other times. The following information is based largely on their observations and record keeping.

Terrapins were initially kept at a private house for assessment and initial rehabilitation. On arrival, many showed signs of poor husbandry, vitamin deficiency and poor diet with several having deformed carapaces due to a combination of poor diet and poor ultraviolet light availability. Terrapins were mainly kept in a large pool that was open to the public to visit. A report on the six years of involvement shows that in the four years from 1996–2000, Secret World took in ninety-six terrapins from the public, of which in 2000, fifty-three remained; thirty-eight red-ears in the Secret World pond and fifteen in quarantine. This fifty-five per cent survival in the transition mainly from small aquarium to a managed small pond indicates both their unsuitability as pets for the general public and the difficulty of rehabilitating terrapins tank-reared often in isolation to a larger environment.

Initially, suffering shock and stress from their change in ownership/environment, many died within weeks of arrival. Stress and contact with new bacteria were thought to be main causes, and over-exercise in a larger outdoor enclosure environment. Weakened by a combination of factors, many contracted infections and died. Initially they were kept in small batches of six or eight, with plenty of individual care, respite time in indoor ponds for those cases losing weight, and were slowly acclimatized over three to six months for life in an outdoor/seasonal pond. Prior to this they were kept in warm, shallow tanks, but their taking to the exterior pond even in the middle of summer proved problematic and mortality increased.

Once released into the outdoor pond they were found to be disoriented. Some treated the slightly cooler water conditions of the outdoor pond as being autumn and as a cue to stop feeding or were otherwise unable to find food. Some released in the outdoor pond vanished but no corpses were ever found. At Secret World, escape and/or theft were suspected and the facility was closed to the public from 2003. Acclimatization was clearly hard for these terrapins, but the records showed quite clearly that for every year that each terrapin survived, their survival became more assured. With thirty-eight remaining at Secret World in the summer of 2002, BCG involvement effectively ended. The experiment had shown that even with dedicated people and huge resources the rehabilitation of terrapins in numbers was highly problematic.

Roman Muryn has numerous experiences from a lifetime of keeping terrapins from around the world. In Somerset he built a deep garden pond to keep terrapins but he also found that rescued terrapins, including those from a park lake, did not survive well upon release into his outdoor pond, for the same reasons as were experienced at the Secret World project. He feels that red-eared terrapins *Trachemys* in general have a poor survival ability in UK ponds as they are a riverine animal that require good levels of oxygenation in order for their system to absorb oxygen during the long winter submersion. With ice covering a shallow garden pond the onset of anoxic conditions occurs quickly and the *Trachemys* capability for surviving these conditions is limited to ten or so days (one reason why the Cardiff 'population' has been successful is that it is river fed). The cooters *Pseudemys,* have similar capability but the painted terrapin *Chrysemys,* a pond dweller from the more northern States, has had to adapt to ponds the freeze over for months and can resist anoxic conditions for over a hundred days under anoxic water and longer in good oxygen conditions (Jackson 2011).

In respect of rehoming, despite the ban on EU importation of red-ears in 1997, there was still from that time a massive lack of rehoming facilities for them in London and southern England and the rest of the UK in general. The BCG turned to the possibility of exporting unwanted UK terrapins to Italy to a project at Massa Maritima in Tuscany, not far from Rome. This was called the CARAPAX project, established and managed in 1989 by the manager, a Belgian national, within a fifteen-hectare visitor centre and thirty-five-hectare reserve. CARAPAX had opened with a series of small, partly connected riverside ponds and flooded ground named 'Florida' where terrapins were released in a fenced-off area. The theory was that the warm conditions potentially reduced greatly the annual care costs from any heated terrapin pond facilities in northern Europe. Initially, hundreds of terrapins were sent to the centre from Italy, Holland, Belgium, Germany and France. The stated capacity of the 'Florida' pools was 4,000 terrapins. BCG started to send turtles to the 'Florida' ponds. Clearly none of the donor organizations had researched what was going to happen to the terrapins in the enclosures offered as the natural maximum density of them in the wild is 350 per hectare with an average of around 160 per hectare (see Ernst, Lovich and Barbour 2009).

Sending a turtle from the UK via the handling system established by BCG cost £25 . This was to pay for individual micro-chipping, veterinary checks and towards long-term care, including a fifteen per cent general overhead towards other CARAPAX running cost. In 2001 came the planning of a new pond called 'Louisiana'. Plans were made for a new purpose-built pond next to the first area. BCG appealed for funds in early 2002. With the collaboration of Virgin Express Airlines (Heathrow to Rome) and much national publicity, the first of many flights took place on 29 April, 2002 (nine red-eared terrapins) relocating unwanted BCG-collected terrapins from all over the country (Zachariou 2004). From 2002 to 2005 over 350 terrapins were sent with funding for long-term care, and by 2007 over 800 had been sent with around £20,000. However, in November 2005 flash floods, not untypical of the terrain, caused many terrapins to escape out of the retaining pond areas. Further floods and dry weather conditions were reported to have delayed the finishing the 'Louisiana' pond project until 2007, where from that year terrapin conditions are reported to have become much worse and strong comments on aspects of the project were being more openly aired (Vetter 2006). The escape, death and suffering of terrapins sent from London and elsewhere in the UK alongside the many thousands from other sources remains a protracted debate because of a complication; a major dispute that developed between CARAPAX and the owners of the site.

In 1989 to 1991 the European Commission funded, as part of the former 'MEDSPA' programme, an international project for the conservation of Mediterranean turtles. The organization carrying out the CARAPAX project was a Belgian-registered organization called 'RANA', significantly financed from 1988 to 1993 by the European Community nature conservation funds. The funds were used for 'structural works' in the area of Massa Marittima (Grosseto), to enable the conservation, reproduction and study of turtles as well as for the modernization and reconversion of existing buildings into a research and visitor centre. The basis for the contest was that funds meant for restoring buildings were used as revenue. A row that had started with complaints regarding terrapin homing welfare at CARAPAX in 2003 came to a head at a meeting in 2009 when three BCG members were expelled for complaining about a project that in their eyes was unethical. BCG persisted with their support and there was a BCG Jan./Feb. 2009 appeal for new nursery building at the CARAPAX centre. However, a European Union ruling in 2010 found against CARAPAX. The legal dispute between the manager of the centre and the local authorities of Tuscany was judged by the Italian national courts. In April 2010 in Italy, the government ruling was that the centre be returned to the local authority, with remaining animals to be taken over by the University of Pisa. In parallel to the land and buildings dispute there were also criminal proceedings in the Grosseto court that gave a six months' suspended custodial sentence to the manager for a number of violations relating to licensing of some of the rarer chelonians at the centre. The centre was then zoned as a hazardous area due to many observers describing the terrapins' release area in terms of being a 'dangerous bacterial soup' of faecal matter and dead decaying terrapins.

Indications are that the Community Montana will continue the work of the CARAPAX centre, ensuring its future development. In March 2010, CARAPAX announced the intention to open a new centre somewhere else but some BCG members began to show concern. During a BCG visit to CARAPAX, red-eared terrapins were seen to be cannibalizing each other and observers felt that that they were overcrowded and not being looked after properly. The lake water was mud brown with algae and sediment with no water-plant life. The density of the terrapins was perhaps a hundred times greater than in the wild. Paul Coleman reported on a web posting 'My 25 large terrapins are fed 110 g of food three times per week. For 4,000 terrapins this would require in excess of 48 kg (106 lb) per week. To distribute this to the terrapins evenly, bearing in mind that each terrapin only has a feeding area of 75 cm square, each would require a boat. I am not assured that any of this is being done, and that any discrepancies in the feeding regime must account for the signs of starvation in the UK terrapins (which, note, are freshly arrived, and many, presumably, still with good energy reserves). For the above reasons, I do not believe that the Louisiana project could be as successful in keeping terrapins alive as at Secret World. Indeed, one might reasonably expect the death rate to be doubled without the ability to weigh, measure and health-check the terrapins on a regular basis. This, scaled up to CARAPAX, suggests a minimum of 400 deaths per annum, and more realistically, this figure could be nearer 600–800 animals'. In fact one of the keepers was reported collecting many dead terrapins every week and also finding the external fence insecure and terrapins escaping into the surrounding countryside.

Another former BCG member comments 'Regrettably most seem to have died. If there were say 4,000 or more deaths, at 1 kg each that would make about four metric tonnes of rotting flesh in the water over the years. It is surprising that anything survived with the bacterial bloom that would have occurred. The water supply downstream was threatened. Various organizations stated that there was no salmonella and papers were quoted stating that turtles don't spread salmonella. Unfortunately those papers dealt with the captive conditions for pets and not hundreds of animals festering in a pond that might be within the watershed supplying the town downstream. The CARAPAX organization must also have known that the saturation point was reached early in the programme, yet it would seem that the pond continued to be loaded with animals provided by those donating organizations.'

This situation has been a disaster for BCG UK terrapin rehabilitation efforts and a welfare tragedy for terrapins. It underlines the hopeless difficulties of trying to clear up after complex, well-meaning but poorly informed mass-housing of pet-trade abandonments. The problems compounded an initial pet trade that is based on high mortality rates, avoidable cruelty and abuse of animals. The situation that developed reflects badly on government and one consequence of the current pet trade industry. Many observers now agree with the RSPCA policy to euthanase unwanted terrapins, even though the occasional tortoise is mistakenly killed through lack of general understanding of the problems.. Effectively this is the evidence needed to enable massive changes to the way that the terrapin trade and terrapin keeping is managed. The Italian authorities need to take strong action to remove the red-eared and other terrapins now roaming in Tuscany where they can both breed and potentially spread disease. How they allowed the project to begin in the first place will now apparently be the subject of an official enquiry.

Book review

Trees of Britain and Ireland. History, folklore, products and ecology. Edward Milner. Natural History Museum, London. 2011. 224 pp. 200 colour photographs. Hardback, £20. ISBN 978 0 565 09295 5.

Edward Milner is probably best known to the Society as our esteemed and very active spider recorder. He also has a passion for trees. Back in 1992 he produced and directed the widely admired television series 'Spirit of Trees'. His first book, *The Tree Book,* accompanied this series and I reviewed it in 1993 (LN 72: 122). In the current book, he builds on the earlier one and explores some of its original themes in more detail. As before, Edward has called upon the knowledge and experience of a wide range of people including Oliver Rackham, George Peterken, Keith Kirby, Alan Stubbs, Ted Green, Roy Vickery and many other tree experts. From this roll call of the 'great and good', Edward has succeeded in distilling (with due acknowledgement), much of the essence of his new book. The result is a very enjoyable and instructive read.

The book concentrates on our native trees (including sycamore and sweet chestnut as 'honorary natives'). Three introductory chapters include a brief account of the post-glacial history of selected trees, a description (by Peterken) of 'trees and woodlands as habitat', a feature (by Keith Alexander) on the importance of dead and decaying trees for fungi and invertebrates, and an account of the ecological strategies of trees (based on the classic work of Philip Grime and the Unit of Comparative Plant Ecology at Sheffield University).

The main body of the book covers individual accounts of tree species in alphabetical order from alder through to yew, treating whitebeams as a group of very similar trees, and sub-dividing the willows into four separate sub-groups. For each tree (or group) there is a brief description of its appearance, its distribution in Britain and Ireland, and its reproductive biology. This is followed by paragraphs covering the uses (to man) of each species, any associated folklore, and a particularly useful account of the roles each tree plays in the ecosystem. The latter includes notes on associated fungi and invertebrates. A range of photographs accompanies each tree illustrating features mentioned in the text. These photographs (around 200 in total) were mainly taken by the author and are of excellent quality, with a number of very striking images. A couple have printed a little too dark to make out the detail (e.g., the ash tree on page 35 and the leaf-roll gall on page 38). Other photographs, including many close-up portraits of invertebrates, were taken by specialists and are also of high quality. These are all duly acknowledged and it was good to see the work of a number of LNHS members on display. However, one of the most striking photographs (p. 34) purports to show a waxwing eating alder buckthorn berries. Unfortunately, the berries are those of a cotoneaster.

Three closing chapters cover: the management of native trees and tree products; the folklore of trees; and the future of our native trees. Under this last heading the author considers the possible destiny of some of our trees under the influence of climate change. He notes that in cities such as London where an urban 'heat island' occurs, certain introduced exotic species like the tree-of-heaven *Ailanthus altissima* and the holm oak *Quercus ilex,* can have a distinct competitive advantage over indigenous species and are becoming widely established. Most recent climate predictions suggest increased temperatures in the UK as a whole (especially in the south-east), so such trees may spread further and could displace native species. In the same chapter the author discusses conservation issues and argues strongly for more *in situ* conservation of vulnerable tree populations to complement that provided by seed banks (which can only preserve seeds from a particular moment in time).

At the back of the book are nine tables setting out various attributes of native trees. These usefully complement the main text and provide much additional information. There is, for example, a listing of thirty-six whitebeams *Sorbus* species, including all the recently named native apomictic species (although *S. admonitor* is listed twice). A further list includes all eighteen native willows (but, understandably, not their hybrids). Table 4 covers 'herbivorous insects associated with native and naturalized tree genera.' Here we discover that a total of 839 insects (and mites) have been found in association with willows *Salix* spp., of which 314 (37 per cent) are restricted to the genus. By contrast, only thirty-two such invertebrates have been recorded in association with holly *Ilex aquifolium,* of which just two (6 per cent) are restricted to that plant. This data, and much more besides, has been painstakingly derived from the Database of Insects and their Food Plants (DIFP) maintained by the Biological Records Centre. It is very useful to have such information immediately to hand, although unfortunately a few minor errors have crept in here and in some of the other tables. These easily corrected slips should not detract from the overall high quality of the book.

This is a tree book with a difference and the author's passion for his subject shines through its many fascinating pages. It deserves to be widely read and enjoyed.

David Bevan

Third update to the list of microlepidoptera of Middlesex (vice-county 21)

COLIN W. PLANT
14 West Road, Bishops Stortford, Hertfordshire CM23 3QP
(E-mail: cpauk1@ntlworld.com)

RACHEL TERRY
92 Woodville Road, Barnet, Hertfordshire EN5 5NJ
(E-mail: swordgrass@btinternet.com)

Abstract

An update is provided to an earlier inventory of the microlepidoptera of the English vice-county of Middlesex. Data are provided for thirty-four species new to the vice-county, one species is deleted from the list and additional information is given for fifty-eight other species of note. With this update, the list of Middlesex micro-moths rises to 964 species.

Introduction

A provisional list of the micro-moths of the Middlesex vice-county (VC 21) was produced almost ten years ago (Plant 2002) and has been updated twice so far (Plant 2004, Plant and Terry 2007). This current paper presents a third and final update before the planned production of a completely revised and updated inventory of Middlesex microlepidoptera is realized. With this in mind, the authors invite readers to submit both individual records of interest and complete lists of all Lepidoptera from all areas of Middlesex at the earliest opportunity.

A revised list of Middlesex microlepidoptera

The original list of species (Plant 2002) was the first attempt at compiling such an inventory since the work by Cockerell (1893) over a century earlier. The aim of the 2002 list was to place in the public domain at least one confirmed, citable record to support the presence of each separate species in the vice-county. No attempt was made to include all records of all species. For the majority of species the exercise was successful, but several of the species included could not be supported by a citable record; in most cases these relate to 'dots' on the distribution maps in the various volumes of the series *The Moths and Butterflies of Great Britain and Ireland* generated from the now defunct Harley Books in Essex. The inclusion of these records allowed us and others to know which species to target in order to seek out valid supporting data. As a result of this exercise, much new data, together with information on species added to the inventory since 2002 have been published in the two updates already cited above.

The end of 2012 will mark ten years since the compilation of the original list. In that period many changes have taken place both within the moth fauna and in the mechanisms by which we record the species. All incoming records are now entered onto a computerized database and although the volume of data varies between species it is now possible to generate distribution maps, phenology charts and other items for many species; these greatly facilitate our understanding of the fauna. The format of the revised list is as yet undetermined, although it is clear that the pages of this journal are inadequate for the presentation of all records of all species. It is likely that we will annotate the inventory with an opinion on distribution and status, perhaps presenting distribution maps for selected species where there are adequate data.

Submission of records

One purpose of this current update is to encourage the submission of further micro-moth records for inclusion in the database. The first author (CWP) remains the formal moth recorder for Middlesex and would welcome all records at the earliest opportunity, although RT is also able to accept data if that proves more convenient. We prefer records in MapMate format, if possible, but we acknowledge the 'golden rule' of taxonomic recording that we should be able to accept records in whatever format they are presented. We are therefore happy to accept paper records as well as records in electronic format as long as they include the basic record requirements of species name, an identifiable location, date of the record, person making the record and the identifier if different. If genitalia dissection has been performed this should be noted. Owners of computerized data are welcome to contact CWP to clarify the format required. Please note that we will not accept MapMate 'sync' files unless we have agreed in advance to do so; this is because the recipient of sync files is prevented from editing the records they contain.

The present update

For conformity, the present report follows the format of Plant (2002). This includes the abbreviations of recorders' names. New recorders are spelled out in full. As before, the species code numbers are those of Bradley (2000).

Microlepidoptera newly found in Middlesex

The following 34 species are reported in Middlesex for the first time:

12 ***Eriocrania sangii* (Wood)**
Occupied leaf-mine recorded at Bushy Park, 25.iv.2011 (TF).

86 ***Stigmella roborella* (Johansson)**
Leaf-mines recorded at North Greenford Countryside Park, 16.xi.2004 (RTy; det. CWP); Leaf-mines recorded at Fir & Pond Wood Nature Reserve, 23.ix.2006 (RTy; det. CWP); Hornsey, N8, at mv light, 5.viii.2007 (MA; gen. det. RTy); adults recorded at Barnet, 16.viii.2008; 28.vi.2009; 3.viii.2010 (RTy).

272 ***Bucculatrix cidarella* (Zell.)**
Leaf-mines recorded in Bushy Park, 24.x and 29.x.2010 (TF).

290 ***Caloptilia semifascia* (Haw.)**
Barnet, 28.vii.2008; 7.x.2008 then annually since (RTy); Perivale Wood, Greenford 5.ix.2008 (D. Howdon; gen.det. RTy); Wembley, as *C. hauderi*, 27.vi.2011, (G. Geiger). Langmaid et al. (2011) have shown that all British records of *Caloptilia hauderi* (Rebel) relate to the spring generation of *C. semifascia*.

292 ***Caloptilia leucapennella* (Steph.)**
Barnet, 29.vi.2010 (RTy).

336 ***Phyllonorycter dubitella* (H.- S.)**
Leaf-mine found on *Salix caprea* (round-leaved), 27.xi.2007 by Longford River, Bushy Park, TQ146697. Adult bred and dissected to confirm (TF).

365 ***Phyllonorycter comparella* (Duponchel)**
Leaf-mines with pupal exuviae on *Populus nigra* in Buckingham Palace Garden, 6.xi.2010 (TF); Alexandra Park, mines on *Populus ?canescens*, 22.ix.2010 (leg. and det. Helen Bantock; det. conf. JRL and Rob Edmunds).

369 ***Phyllocnistis xenia* Hering**
Alexandra Park, mines on *Populus ?canescens*, 22.ix.2010 (leg. and det. Helen Bantock).

429 ***Yponomeuta irrorella* (Hb.)**
Greenford 9.vii.2010 (D. Howdon; gen.det. RTy).

444 ***Ocnerostoma piniariella* (Zell.)**
Wood Green, 4.vii1.2006 (MA; gen. det. RTy).

521 ***Colephora conyzae* (Zell.)**
Barnet, 24 and 29.vi.2009 (RTy).

557 ***Coleophora gardesanella* (Toll.)**
Wood Green, 16.viii.2009 (MA; gen. det. RTy).

603 ***Elachista subnigrella* (Doug.)**
Regent's Park, 22.v.2004 (2) (TF gen. det.).

668 ***Luquetia lobella* (D. & S.)**
Barnet, 23.vi.2008 (RTy).

798 ***Neofriseria peliella* (Treit.)**
Wood Green, 20.vii.2006 (MA; gen. det. RTy). A surprising, but correct record.

844 ***Syncopacma larseniella* (Gozm.)**
Horsenden Hill, Greenford, 21.vi.2003; 12.vi.2004 (RTy). In our original list we included only the *larseniella/cinctella* species pair, adding that a record of *cinctella* from Ruislip was not acceptable because the specimen was not dissected. The present record thus formally adds *larseniella* to the Middlesex list. There remain no confirmed records of *cinctella* in the vice-county. It is of interest that in neighbouring Hertfordshire to the north *larseniella* is not uncommon, whilst *cinctella* appears to be rare.

857 ***Anarsia lineatella* (Zell.)**
Barnet, 30.vi.2009 (RTy); Greenford, 30.vi.2010 (D. Howdon; gen. det. RTy).

879 ***Batrachedra pinicolella* (Zell.)**
Barnet, 26.vi.2009 (RTy); Greenford, 29.vi.2009 (D. Howdon; gen.det. RTy).

879a ***Batrachedra parvulipunctella* (Chrétien)**
Barnet, 28.x.2010 (RTy).

1022a ***Cnephasia pumicana* (Zell.)**
Barnet, 30.vii.2010 (RTy). Newly recognized species, formerly confused with *Cnephasia pasiuana* (Hb.) — see Langmaid and Agassiz (2010). All British records of *pasiuana* require revisiting; the two species are separable only by examination of characters of the genitalia.

1023 ***Cnephasia genitalana* P. & M.**
Bushy Park TQ 1469, 11.vii.2006, gen. det. (TF); Wood Green, 2.vii.2009 (MA; gen. det. RTy).

1051 ***Acleris logiana* (Cl.)**
Ruislip Woods, 4.xi.2008 (D. Howdon; gen. det. RTy); Buckingham Palace Garden, 1.vii.2009 (TF); Barnet, 29.vi.2010 (RTy); Wood Green, 11.vii.2010 (MA; det. RTy).

1067 ***Celypha cespitana* (Hb.)**
Bushy Park TQ 1469, 11.vii.2005, gen. det. (TF).

1101 ***Endothenia ustulana* (Haw.)**
Perivale Wood, Greenford, 3.vii.2009 (D. Howdon; gen. det. RTy).

1110 ***Bactra furfurana* (Haw.)**
Bushy Park TQ 1569, 4.viii.2006, gen. det. (TF).

1144 ***Epinotia signatana* (Dougl.)**
Perivale Wood, Greenford, 3.vii.2009 (D. Howdon; gen. det. RTy).

1226 ***Pammene agnotana* (Rebel.)**
Fir & Pond Wood Nature Reserve, 18.iv.2009 (RTy).

1249 ***Grapholita lobarzewskii* (Nowicki)**
Barnet, 30.vi.2009 (RTy); Barnet, 9 and 16.vii.2010 (RTy).

1275 ***Dichrorampha flavidorsana* (Knaggs)**
In the original list we noted a report of this species from Ruislip, but did not accept the record because no specimens had been dissected to separate them from 1274: *D. alpinana* (Tr.). We now have numerous records from Barnet from 2008 to 2010, including, for example, 19.vi.2003 and 13.vi.2006 (RTy).

— ***Carposina*** ?sp. nov.
A moth taken in a garden in Wembley on 17.viii.2009 by Geoffrey Geiger belongs to the family Carposinidae which, hitherto, is not recorded in Britain. It is likely to have been imported with produce from overseas. The specimen, a male, which is unfortunately in poor condition, has distinctive characters within the genital capsule and to date we have been unable to allocate it to any of the known world species. It is retained in the collection of CWP.

1365 ***Pyrausta despicata* (Scop.)**
Wood Green, 4.ix.2010 (MA; gen. det. RTy).

1403 ***Diasemiopsis ramburialis* (Dup.)**
One at light in the Muswell Hill area, 17.viii.2002 (Brian Price).

1494 ***Capperia britanniodactyla* (Gregs.)**
Fir & Pond Wood Nature Reserve, 26.vi.2009 (RTy).

1517 ***Adaina microdactyla* (Hb.)**
One at mv light, 4.viii.2006 in Pheasantry Yard, Bushy Park, TQ 157699, and two adults at mv light in Bird Hide, Bushy Park, TQ 146695, 27.vii.2007 (TF).

Confirmation of previously unsupported taxa

The following sixteen species have already been included in the list and its two updates on the basis, in most cases, of a dot appearing in the distribution map in the appropriate volume of *The Moths and Butterflies of Great Britain and Ireland* (Harley Books), but without any supporting data. A supporting record is now provided for each:

25 ***Ectoedemia intimella* (Zell.)**
Leaf-mine recorded in Bushy Park, 29.x.2010 (TF).

41 ***Ectoedemia atrifrontella* (Stt.)**
One at mv light along wooded border in Bushy Park, TQ166692, 22.viii.2006, gen. det. (TF).

64 ***Stigmella continuella* (Stt.)**
Leaf-mines on *Betula pubescens* recorded at Fir & Pond Wood LNR, 23.ix.2006 (RTy).

78 ***Stigmella incognitella* (H.- S.)**
Barnet, 13.v.2008; 9.viii.2009; 4.vi.2010 (RTy).

226 ***Triaxomasia caprimulgella* (Stain.)**
Chelsea Physic Garden, 19.vi.2006 (TF).

354 ***Phyllonorycter emberizaepenella* (Bouché)**
Leaf-mine recorded in Buckingham Palace Garden, 27.x.2009, adult bred (TF).

367 ***Phyllocnistis saligna* (Zell.)**
Barnet, 9.vii.2010 (RTy). Previously recorded in 'Chiswick on *Salix*' (published in 1925), but with no data.

485 ***Schreckensteinia festaliella* (Hb.)**
Fir & Pond Wood Nature Reserve, 16.vii.2009; 21.iv.2011 (RTy).

714 ***Agonopteryx yeatiana* (Fabr.)**
Horsenden Hill, Greenford, 29.iii.2003 (RTy); Wood Green, June 2003 (MA; gen. det. RTy); Barnet, 7.vi.2004 (RTy); Perivale Wood, Greenford, 9.iii.2005 (D. Howdon and A. Culshaw; in coll. RTy).

728 ***Monochroa cytisella* (Curtis)**
Bushy Park, 1 on 1.viii.2007 Bushy Park, 2 on 10.vii.2009, gen. det. (TF); Wood Green, 9.viii.2010 (MA; gen. det. RTy).

790 ***Chionodes fumatella* (Douglas)**
Wood Green, a male on 1.viii.2007 (MA; gen. det. RTy).

0950 ***Aethes francillana* (Fabr.)**
Greenford, 22.vii.2008 (A. Culshaw; gen. det. RTy).

0952 ***Commophila aeneana* (Hb.)**
Paradise Fields, Greenford, 8.v.2011 (A. Culshaw; in coll. RTy).

1061 ***Acleris literana* (L.)**
Horsenden Hill, Greenford, 14.xi.2009 (D. Howdon; in coll. RTy).

1094 ***Apotomis capreana* (Hb.)**
Bushy Park, 21.vi.2010 (TF).

1187 ***Epiblema costipunctana* (Haw.)**
Greenford, 20.vii.2009 (A. Culshaw; gen. det. RTy).

Significant updates of species already listed

Records are now given for forty-two species that are already listed for Middlesex; these are of significance for the reasons stated:

8 ***Eriocrania unimaculella* (Zett.)**
Occupied leaf-mine recorded at Bushy Park, 25.iv.2011 (TF). First report since 1964.

21 ***Ectoedemia sericopeza* (Zell.)**
Holland Park, 9.vii.2010 (TF). Second Middlesex record, although the species is probably under-recorded.

35 ***Ectoedemia minimella* (Zett.)**
Leaf-mine recorded in Buckingham Palace Garden, 7.xi.2008 (TF). Last recorded on Hampstead Heath in 1983.

37 ***Ectoedemia albifasciella* (Hein.)**
Leaf-mine recorded in Bushy Park, 29.x.2010 (TF). Last recorded on Stanmore Common in 1988.

46 ***Trifurcula immundella* (Zell.)**
Wood Green, 9.viii.2010 (MA; gen. det. RTy). Previously recorded as mines: first adult record.

117 ***Stigmella confusella* (Wood)**
Leaf-mines recorded at Fir & Pond LNR, 19.x.2006 and 9.vi.2008 (RTy). Leaf-mine recorded in Buckingham Palace Garden, 12.ix.2008 (TF). Last recorded in 1994 at Kensal Green Cemetery.

180 ***Diplodoma herminata* (Geoff.)**
Perivale Wood, Greenford 22.vi.2007 (D. Howdon and A. Culshaw; gen. det RTy). Added to the Middlesex list in the 2007 updates, this is the second record and site for this species.

185 ***Luffia ferchaultella* (Steph.)**
Larval cases recorded in Buckingham Palace Garden, 21.v.2010 and Bushy Park, 3.vi.2010 (TF). Our only other confirmed record is from Osterley Park in 1987.

256 ***Leucoptera spartifoliella* (Hb.)**
Barnet, 30.vi.2009; 2.vii.2009 (RTy). Last recorded on Stanmore Common in 1965.

260 ***Leucoptera malifoliella* (Costa)**
Barnet, 10.vi.2007; 2.vi.2010 (RTy). Last recorded at Ealing in 1910.

324 ***Phyllonorycter sorbi* (Frey.)**
Leaf-mines recorded in Buckingham Palace Garden, 21.xi.2006; 6.xi.2010, adults bred (TF). Last recorded at Stanmore Common in 1988.

409b ***Argyresthia cupressella* Wals.**
Hackney, 29.v.2011(Matthew Gandy). Added to the Middlesex list in our 2007 update (Hornsey, 9.vi.2006, MA) where we suggested that it was a new arrival. We have other records in addition to that from Hackney and this species appears to have established itself here.

412 ***Argyresthia pygmaeella* (D. & S.)**
Bushy Park, 21.vi.2010 (TF); Barnet, 1.vii.2010 (RTy). Last recorded in Buckingham Palace Garden in 1963.

423 ***Argyresthia semitestacella* (Curtis)**
Holland Park, 18.ix.2009 (TF gen. det.). Last recorded at Osterley Park in 1987.

436 ***Pseudoswammerdamia combinella* (Hb.)**
Perivale Wood, Greenford 13.v.2005; 13.v.2006 (D. Howdon and A. Culshaw; in coll. RTy); Barnet 23.iv.2011 (RTy). Last recorded at Ruislip in 1959.

449b ***Prays peregrina* Agassiz, 2007**
The mystery species reported in our 2007 update has been described by David Agassiz (2007) as *Prays peregrina* — a species new to science. There are several additional records, notably from Barnet on 5.x.2005; 18.x.2006; 25.x.2009; 7.x.2010 (RTy) — a series that perhaps suggests local establishment rather than repeated importation with foreign produce. The larval pabulum of this species is unknown.

442 ***Cedestis gysseleniella* Zell.**
Chelsea Physic Garden, 19.vi.2005 (TF). This species was included in our in 2004 update, but this record pre-dates that data.

443 ***Cedestis subfasciella* (Steph.)**
Holland Park, 7.vi.2008 (4) (TF). Last recorded at Enfield in 1975.

504 ***Coleophora lusciniaepennela* (Tr.)**
Fir & Pond Woods LNR, 26.vi.2009 (RTy); Barnet, 10.viii.2010 (RTy). Last recorded on Stanmore Common in 1988.

511 ***Coleophora orbitella* (Zell.)**
Barnet, 23.vi.2009 (RTy). Last recorded on Stanmore Common in 1965.

515 ***Coleophora albitarsella* (Zell.)**
Barnet, 23.vii.2008; 9.vii.2009 (RTy). Last recorded at Chiswick in 1903.

560 ***Coleophora paripennella* (Zell.)**
Barnet, 17.v.2007 (RTy). Last recorded at Stanmore in 1965.

568 ***Coleophora versurella* Zell.**
Grove Farm LNR, Greenford, 3.vii.2004 (D. Howdon and A. Culshaw; gen.det. RTy); Bushy Park, 11.vii.2005 (TF gen. det.); Barnet, 23.vii.2008; 2.vii.2009 (RTy). Last recorded at Osterley Park in 1987.

588 ***Coleophora salicorniae* Hein. & Wocke**
A second site is recorded for this species: Wood Green, 28.vii.2004 (MA; gen.det. RTy), the only other site being the Wildlife Garden at the Natural History Museum in South Kensington.

601 ***Elachista albifrontella* (Hb.)**
Fir & Pond Wood Nature Reserve, 18.iv.2009 (RTy). Last recorded at Harrow Weald in 1965.

678 ***Depressaria sordidatella* (Tengst.)**
Horsenden Hill, Greenford, 12.vii.2004 (RTy), Perivale Wood, Greenford, 30.vii 2004; 1.viii.2008 (D. Howdon and A. Culshaw; gen. det. RTy). Last recorded Hampstead, 1988.

735 ***Monochroa tenebrella* (Hb.)**
Fir & Pond Woods LNR, 5.vii.2007; 1.viii.2009 (RTy), the only other record is Enfield, 1979.

770 ***Carpatolechia proximella* (Hb.)**
Barnet, 28.iv.2011 (gen. det. RTy). Last recorded Enfield, 1972.

841 ***Sophronia semicostella* (Hb.)**
Bushy Park, 9.vii and 11.vii.2005 (3); Buckingham Palace Garden, 2.vii.2008 (TF). Last recorded at Buckingham Palace Garden in 1963.

856 ***Anarsia spartiella* (Schr.)**
Greenford, 30.vi.2010 (A. Culshaw; gen. det. RTy). Last recorded at Buckingham Palace Garden in 1972.

859 ***Psoricoptera gibbosella* (Zell.)**
Grove Farm LNR, Greenford, 22.viii.2003 (RTy); Perivale Wood, Greenford, 22.vii.2005 (D. Howdon and A. Culshaw; gen.det. RTy); Barnet, 16.ix.2006 (RTy); Fir & Pond Woods LNR, 1.ix.2006 (RTy). Last recorded at Fir & Pond Wood in 1977.

877 ***Stathmopoda pedella* (L.)**
Buckingham Palace Garden, TQ 2879, 4.vii.2006 (TF). Bushy Park, 22.vi.2010 (TF). Fir & Pond Woods Nature Reserve, 21.iv.2011 (RTy). First Middlesex records since 1867.

926 ***Phalonidia manniana* (F. v. R.)**
Bushy Park, two on 28.vii.2010 (TF leg., gen. det.). Last recorded at Osterley Park in 1987.

946 ***Aethes rubigana* (Tr.)**
Fir & Pond Woods Nature Reserve, 26.vi.2009 (RTy) Bushy Park, 4 on 10.vii.2009 (TF). Last recorded at Osterley Park in 1987.

1018 ***Cnephasia communana* (H.-S.)**
Regent's Park, 15.v.2003 (TF leg., gen. det.); Bushy Park, 2.vi.2010 (TF leg., gen. det.). This species was also included in the 2004 update, but the first record pre-dates that data.

1047 ***Acleris schalleriana* (L.)**
Hampstead, a male to actinic light, 20.ii.2009 (RAS; gen. det. CWP). This species is included in the 2007 update and we now have several other records from northern Middlesex suggesting that it has become common here.

1104 ***Endothenia quadrimaculana* (Haw.)**
Grove Farm LNR, Greenford, 3.vii.2004 (RTy): Bushy Park, 12 and 24.vi.2006 (TF); Barnet, 18.viii.2008 (RTy). Last recorded at Ruislip in 1959.

1228 ***Pammene argyrana* (Hb.)**
Perivale Wood, Greenford 29.iv.2005 (D. Howdon and A. Culshaw; gen. det. RTy); Bushy Park, 24.iv.2006 (TF); Horsenden Hill, Greenford 16.v.2006 (D. Howdon; gen. det. RTy).

1284 ***Dichrorampha vancouverana* McDunnough (= *gueneana* Obraztsov)**
Barnet, 28.vi.2005; 19.vii.2006; 3.vii.2009 (RTy); St James's Park, 28.vii.2008 (TF leg; gen. det.). Only other Middlesex record is Ruislip prior to 1959.

1306 ***Agriphila latistria* (Haw.)**
One at Wembley on 24.viii.2009 (G. Geiger) is the first since 1996 and perhaps only the second Middlesex record (Minnion 1959).

1465 ***Nephopterix angustella* (Hb.)**
Holland Park, 9.vii.2010 (TF). Last recorded at Hampstead in 1992.

1478 ***Ephestia calidella* (Guen.)**
One found in the BM(NH), South Kensington, 5.xi.1982; leg. K. R. Tuck, specimen in BM(NH). The only other Middlesex record is that given for 'Hackney and the City of London' by Prout (1902).

Corrections

The following important corrections need to be drawn to attention:

136 ***Lampronia corticella* (L.)**
The record from Woodville Road, Barnet, 8.vi.2005 is incorrect, specimen proved to be 310: *Callisto denticulella* on dissection. The species remains on the list owing to a 1959 Ruislip record.

1146 ***Epinotia rubiginosana* (H.-.S.)**
In Plant and Terry (2007) species 1146 is listed as *Endothenia rubiginosana*, this should of course be *Epinotia rubiginosana*.

Deletions

One species must be deleted from the Middlesex list for the reason stated:

1022 ***Cnephasia pasiuana* (Hb.)**
Langmaid and Agassiz (2010) have shown that *pasiuana* comprises two species — *pasiuana* sensu stricto and *pumicana*. Separation is by means of examination of features of the genitalia and so far, all Middlesex material has proved to belong to *pumicana*. Consequently, there are no valid records of *pasiuana* from Middlesex and that species must be deleted from the inventory.

Acknowledgements

We acknowledge, in particular, the significant contribution made to this update by Tim Freed. However, in doing so we do not wish to diminish, in any way, the value of records received from a great many other people. It is important to emphasize that records of **all** species are added to the newly computerized Middlesex Moth Database and the absence of a mention in this report does not mean that we have overlooked any contribution. We also gratefully acknowledge the ongoing assistance of Mandy Rudd, Director of Greenspace Information for Greater London (GiGL), and her staff, in digitizing the huge backlog of Middlesex Lepidoptera records and providing these data back to us in a standard format for importation to the LNHS database.

References

AGASSIZ, D. 2007. *Prays peregrina* sp. n. (Yponomeutidae) a presumed adventive species in Greater London. *Nota Lepidopterologica* **30**(2): 407–410.

BRADLEY, J. D. 2000. *Checklist of Lepidoptera recorded from the British Isles*. Ed. 2, revised. Privately published.

COCKERELL, T. D. A. 1893. A preliminary list of the insect fauna of Middlesex. Lepidoptera. *Entomologist* **26**: 102–105. (Continuation of earlier parts).

LANGMAID, J. R. L. and AGASSIZ, D. J. L. 2010. *Cnephasia pumicana* (Zeller, 1847) (Lep.: Tortricidae) *stat. rev.* newly recognized as British. *Entomologist's Rec. J. Var.* **122**: 137–142.

LANGMAID, J. R., SATTLER, K. and LOPEZ-VAAMONDE, C. 2011. Morphology and DNA barcodes show that *Calybites hauderi* does not occur in the British Isles (Gracillariidae). *Nota Lepidopterologica* **33**(2): 191–197.

MINNION, W. E. 1959. Lepidoptera of Ruislip. Part VII. *J. Ruislip Distr. nat. Hist. Soc.* **8**: 19–24.

PLANT, C. W. 2002. A provisional list of the microlepidoptera of Middlesex (vice-county 21). *Lond. Nat.* **81**: 123–186.

PLANT, C. W. 2004. Additions and corrections to the provisional list of the microlepidoptera of Middlesex (vice-county 21). *Lond. Nat.* **83**: 107–109.

PLANT, C. W. and TERRY, R. 2007. Further additions and corrections to the list of Middlesex micro-moths (Lepidoptera). *Lond. Nat.* **86**: 87–93.

PROUT, L. B. 1902. The fauna of the London district: Lepidoptera. Supplement. *Trans. Cy Lond. ent. nat. Hist. Soc.* **11**: 58–65.

Book review

Guide to British freshwater macroinvertebrates for biotic assessment. Compiled by Simon Pawlet with contributions from Michael Dobson and Melanie Fletcher. Freshwater Biological Association Scientific Publication No. 67. 2011. 78 pp., 246 × 171 mm, softback. ISBN 978 0 900386 79 4. £25 plus p. & p. from FBA, The Ferry Landing, Far Sawrey, Ambleside, Cumbria LA22 0LB. Tel. 01539 442468.

This guide is aimed at anyone interested in undertaking biological surveys and as a helpful introduction to the identification of freshwater invertebrates. Macroinvertebrates are basically those members of the invertebrate fauna that are clearly visible to the naked eye, although the watermites (Hydracarina), which may be abundant, and are ectoparasitic in the larval stages, are not normally covered in the biological assessment of fresh water. It goes without saying that the variety and abundance of aquatic invertebrates in fresh flowing water is an indicator of the water quality, and most biotic assessment systems are designed to concentrate on families typical of rivers and streams. This guide does not provide comprehensive coverage for lake and pond faunas, though occasionally some still-water inhabitants may stray into running waters.

Keys are provided for identification to families of each of the orders covered and these are supplemented with clear line drawings of either complete animals or the parts necessary for identification, for instance, leg segments or mouthparts.

As one would expect from the FBA, this is a well-produced, easy-to-follow guide to the macroinvertebrate fauna. After a pleasant day (but in reality, with great concentration) collecting and picnicking, and watching the river or stream quietly flowing past, what better way of spending the evening with the binocular microscope identifying the samples collected. The Further Reading section provides a list of titles that give more comprehensive coverage of the ecology and biology of the major groups. A number of the suggested titles are also FBA publications.

K. H. Hyatt

London butterfly monitoring report for 2010

L. R. WILLIAMS

34 Christchurch Avenue, Kenton, Harrow, Middlesex HA3 8NJ

Abstract 187
Introduction 187
Methods 187
Results 188
Discussion 198
Acknowledgements 198
References 199

Abstract

Data from twenty-five sites in London, monitored using the transect walks method, were used to calculate collated indices for 2010 and to enable comparisons with previous years. Species accounts were supplemented by records from other sites, surveys and observations.

Introduction

Monitoring of butterflies was undertaken by a standard method at sites in London in 2010. These provided data for the calculation of collated indices of changes in the abundance of butterfly species as compared with previous years. London is defined for the purposes of this paper as Greater London or the area encompassed by the London boroughs. Additional records from the wider London Natural History Society (LNHS) recording area were noted and/or made available to other regional and national recording systems.

Methods

Monitoring was undertaken by the transect walk method, a standard method adopted throughout the United Kingdom. Details of the method are described elsewhere: see Pollard and Yates (1993), Williams (2000), and the UK Butterfly Monitoring Scheme at www.ukbms.org. Basically, at each site a walk was undertaken along the same route, each week between April and September inclusive, within a standard range of weather conditions conducive to butterfly flight. Counts were made of the number of adult butterflies observed to provide a total for each species for the year at each transect. Totals used for this paper include calculated estimates for weeks missed due to poor weather or the unavailability of the recorders. However, for inclusion in the index, data from each transect required good coverage during the recording season and with the minimum of missed weeks. To contribute to the indices, data from each transect must be available for at least two years, though these do not need to be consecutive. Collated indices were calculated from the data as described by Williams (2000), but see also Crawford (1991) for an introduction to the use of collated indices in wildlife monitoring; and also Pollard and Yates (1993) and Roy and Rothery (2002). Note that neither the original site counts nor the collated indices are absolute counts of the population, but indices of abundance for each species. Estimates of the relative changes in the populations of each species from year to year are given by the difference in the indices. For example, a species with an index of 50 in one year and 25 in the following year would have had approximately half the adult population in the second year as compared with the first year. Indices have been rounded to the nearest whole number and were generally set at 100 in 1990 or the first year of record: for a technical discussion see Crawford (1991). Reliability of indices increases with the number of transects; in the earlier years these were relatively few, e.g., one transect was walked in 1978, two in 1986, three in 1988 and eight in 1990. Reliability of the indices may be lower for species with low counts and/or local distribution in London. The 'Total count on transects' provides an indication of the size of the count from which the analysis was made in 2010 using the data from the complete transects for that species, including estimated counts for missing weeks; but excluding the computed estimated counts for transects that were not walked or had insufficient data in 2010.

Transects that contributed data in 2010, the years for which data were available and the Borough in which the transect was located were: **Hampstead Heath** (Camden) 1978–2010, **Fryent Country Park** (Brent) 1986–2010, **Beane Hill** (Brent) 1988–2010, **Gutteridge Wood** (Hillingdon) 1990–2010, three transects managed by the Corporation of London (located in the London Borough of Croydon): **Coulsdon Common** 1990–2010, **Farthing Downs** 1990–2010, **Riddlesdown** 1990–2010; **Mitcham Common 'route A'** (Merton) 1994–2001, 2003–2010, **Mitcham Common 'route B'** (Merton) 1995–2010, **Wildfowl and Wetlands Trust Wetland Centre at Barn Elms** (Richmond upon Thames) 1996–2010, **Railway Fields** (Haringey) 1997–2010, **Hutchinson's Bank Nature Reserve** (Croydon) 1997–2010, **Cranford Park** (Hounslow) 1997–2005, 2010, **South Norwood Country Park** (Croydon/Bromley) 1998–2010, **Tower Hamlets Cemetery Park** (Tower Hamlets) 1999–2010, **Gunnersbury Triangle** (Hounslow) 1999–2010, **Brent Reservoir** (Barnet/Brent) 2000–2010, **Regent's Canal towpath from Mile End Road to Mare Street** (Tower Hamlets/Hackney) 2001–2010, **Riddlesdown Quarry** (Croydon) 2001–2005, 2008–2010, **Kenwood Estate** (Camden) 2005–2010, **Horsenden Hill East** (Ealing) 2005–2010, **Horsenden Hill West** (Ealing) 2005–2010, **Perivale Wood** (Ealing) 2005–2010, **Farthing Downs New Hill** (Croydon) 2005–2010, and **Spring Park** (Croydon/Bromley) 2001–2006, 2010. Recorders for 2010 are listed in the Acknowledgements. For some sites, the indices have been updated with data from earlier years that were not available previously.

The transect at Kenley Common was walked in 2010 but in too few weeks for calculation of indices. The transect at Bedfont Lakes was walked and it is hoped to include this in future indices. Records from other transects and LNHS observations have been included in the species accounts where appropriate. Transects beyond Greater London but within the LNHS area are not included in these collated indices.

The London transects contribute towards the national indices of the UK Butterfly Monitoring Scheme and for results up to 2009, refer to Botham et al. (2010). Records also contribute towards the data held by Greenspace Information for Greater London (GiGL). For the wider LNHS area reference should be made to the respective county data and reports produced by Butterfly Conservation (e.g., Wood 2011) and other teams.

Results

The order and nomenclature of the species accounts follow Asher et al. (2001). The accounts are based on the collated indices which commenced in 1978, and which for the years 2000 to 2010 are presented in Table 1. As some year-to-year variations are to be expected the comments are focused on the more pronounced changes and on longer-term trends.

SMALL SKIPPER *Thymelicus sylvestris* and ESSEX SKIPPER *Thymelicus lineola*

Small and Essex skippers are considered together as they were generally counted together by transect walkers due to the difficulty of separately identifying the two species while they are in flight. Both species are dependent on rough grassland habitat, and whilst they are widespread there is evidence of a long-term decline in London. For 2010 the index for these two species was the lowest for over twenty years and probably since butterfly monitoring commenced in London in 1978, though their distribution remains widespread. While there has been some stability during recent years, population indices were generally higher in the years up to 1997. While reductions in numbers in 2010 at Mitcham Common route A and at Cranford Park influenced the index, reduced populations have been noted at other sites during the past two decades. Wood (2011) noted a similar decline in Hertfordshire. At eleven of the London transects, recorders managed to identify some of the individuals to species level; and of 108 skippers, 70 per cent (76) were small skippers and 30 per cent (32) were Essex skippers. Total count on transects: 812.

Large skipper *Ochlodes sylvanus* (Figure 1)

A species of rough grassland and scrub, the large skipper was widespread in London. Total count on transects: 343.

Dingy skipper *Erynnis tages*

The typical habitat of the dingy skipper is of short grassland containing the larval food plants, with some bare patches and taller vegetation to provide shelter and roosting areas (Asher et al. 2001). In London it is effectively confined to chalk downland sites on the southern edge of the area. The majority of the records were from Hutchinson's Bank Nature Reserve and it was also recorded at Riddlesdown Quarry and at New Hill. Total count on transects: 35.

Grizzled skipper *Pyrgus malvae*

A species of unimproved grasslands containing spring nectar plants and the larval foodplants, preferably with bare patches and taller vegetation (Asher et al. 2001). In London it is effectively confined to a few chalk downland sites on the southern edge of the area. In 2010 it was recorded at Hutchinson's Bank Nature Reserve. Total count on transects: 7.

Brimstone *Gonepteryx rhamni*

The brimstone occurs in woodland edge and more-open habitats wherever the larval foodplants, particularly alder buckthorn *Frangula alnus,* and on drier soils, common buckthorn *Rhamnus cathartica*, occur. Though they range widely in search of these, the species was apparently absent from a large swathe of north London at the time of the LNHS survey in the 1980s (Plant 1987). During the past two decades, alder buckthorn has been planted at numerous locations in north London and has contributed to the establishment of populations. At sites where the brimstone is established, numbers, and hence the London index, tends to follow wider regional and national variations from year to year. The index in 2010 was lower compared with 2009 and reflected lower counts at the majority of transects in 2010. Total count on transects: 510.

Large white *Pieris brassicae*

The large white ranges widely but is particularly associated with locations where the larval foodplants, species of *Brassica* occur, and particularly in agricultural areas where *Brassica* field crops are grown, and in urban areas with gardens and allotments. In 2010, there were lower counts at almost all sites and a lower index compared with the 2009 high. Total count on transects: 566.

Small white *Pieris rapae*

Associated with *Brassica* plants, the small white breeds on crops and also on a wide variety of wild and garden foodplants. The London results indicate a strong association with green spaces in urban areas, and for example it

Table 1. Collated indices for butterfly species in London, 2000–2010. Indices have been rounded to the nearest whole number and have usually been set at 100 in 1990 or the first year of record, though indices may be set at 100 in other years or at a different figure where this aids interpretation. A blank indicates that the species had not yet been recorded on any transect in London. A zero indicates that a species was not observed on transects in that year but had previously been observed on a transect in London.

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Small and Essex skippers	75	87	73	73	77	80	75	62	61	64	34
Large skipper	50	37	63	90	60	65	50	45	28	67	54
Dingy skipper	63	39	69	102	68	55	26	14	15	29	38
Grizzled skipper	28	16	48	41	81	21	26	44	67	117	29
Clouded yellow	2,255	0	75	121	108	0	554	24	88	300	0
Brimstone	113	89	89	76	107	104	97	69	72	133	85
Large white	122	105	171	112	142	156	141	69	115	298	90
Small white	136	118	152	173	252	204	185	188	151	227	165
Green-veined white	96	62	99	77	98	67	59	51	50	97	56
Orange tip	75	61	77	42	63	74	50	34	38	76	75
Green hairstreak	31	125	179	73	105	62	41	104	67	73	54
Purple hairstreak	295	200	338	203	301	473	343	323	425	488	558
White-letter hairstreak	8	17	10	12	8	55	87	19	24	64	55
Small copper	21	5	6	57	50	20	54	46	30	47	46
Small blue	188	363	191	40	60	121	479	288	174	323	1,169
Brown argus	15	6	15	28	28	12	29	22	13	19	39
Common blue	69	39	49	141	62	53	115	33	40	89	128
Chalkhill blue	90	85	39	39	89	29	129	10	3	10	8
Holly blue	43	50	41	42	61	70	39	69	61	23	42
White admiral	0	0	0	0	100	0	0	0	100	0	100
Purple emperor						100	0	0	0	0	0
Red admiral	256	188	204	412	129	162	380	394	144	1,421	153
Painted lady	59	7	70	376	36	3	227	36	4	998	18
Small tortoiseshell	72	44	25	67	144	52	26	12	5	10	24
Large tortoiseshell										100	0
Peacock	1,466	1,064	641	386	588	508	314	397	314	852	618
Comma	199	146	131	201	148	122	226	115	116	300	147
Dark green fritillary	63	7	11	91	9	4	0	0	0	11	7
Silver-washed fritillary	300	100	0	0	0	125	500	0	0	125	625
Speckled wood	176	148	205	232	140	149	132	123	190	238	133
Marbled white	40	14	18	35	25	13	37	33	55	62	37
Gatekeeper	148	132	127	161	204	244	199	156	151	184	166
Meadow brown	145	90	66	136	113	148	129	75	83	78	50
Ringlet	466	233	292	389	226	171	209	141	264	325	284
Small heath	2	1	1	8	6	9	10	11	7	8	10

accounted for the large majority of records on the Regent's Canal transect. Phil MacMurdie (2010) recorded the small white as the most frequent butterfly on an urban route in the City of London covering parts of the Liverpool Street and Barbican areas, EC1–2. Recorded on all of the transects in 2010 but with a lower index than in 2009. Total count on transects: 1,771.

GREEN-VEINED WHITE *Pieris napi*

The green-veined white occurs widely and particularly in damp grassland, and alongside hedgerows, woodland, ditches, and water where wild crucifer foodplants grow. Total count on transects: 927.

ORANGE TIP *Anthocharis cardamines* (Figure 2)

A species of damp meadows, hedgerows, woodlands, roadsides and waterside habitats where crucifer foodplants occur, in particular cuckooflower *Cardamine pratensis* and garlic mustard *Alliaria petiolata*. Orange tips were recorded on all but three transects in 2010. Total count on transects: 379.

GREEN HAIRSTREAK *Callophrys rubi*

A species of unimproved grasslands with shrubs and scrub, the green hairstreak was recorded from three transects, all in south London and generally chalk-based sites. Chris Rose recorded one larva on a gorse bush at Barnehurst Golf Course, Bexley. Total count on transects: 10.

PURPLE HAIRSTREAK *Neozephyrus quercus*

Colonies of the purple hairstreak are associated with oak *Quercus* spp. In London, the 2010 index was at the highest since at least 1991 and probably since butterfly transect monitoring commenced in London in 1978. Over half of the total count from transects was from the Kenwood Estate, with other populations at the Brent Reservoir and Mitcham Common route A, and at three other transects, in addition to records from Oakhill Woods, Barnet, and at Alexandra Park. Purple hairstreaks generally fly in the evening and were possibly more frequent and widespread than suggested by the daytime transects, particularly where there were oak trees and woodland with oak. Wood (2011) also comments that the higher numbers could have been due to dry weather which may have encouraged the butterflies to feed nearer to the ground rather than in the canopy of oak trees where they were less easy to record. Total count on transects: 121.

WHITE-LETTER HAIRSTREAK *Satyrium w-album* (Figure 3)

White-letter hairstreaks use elm *Ulmus* spp. for breeding, and with the loss of mature elm trees in the 1970s, the butterfly is now associated in London with younger elms that have grown from suckers in hedgerows and woodland edges. In 2010 they were observed on the transects at Brent Reservoir, Horsenden Hill East, Horsenden Hill West, Hampstead Heath and Cranford Park; and there were sightings at Moat Lane on Crayford Marshes and at Barnehurst Golf Course, Bexley. Andy Culshaw and David Howdon organized an LNHS event at Horsenden Hill and recorded sixteen white-letter hairstreaks on the pre-walk preparation. Total count on transects: 25.

SMALL COPPER *Lycaena phlaeas*

Dry, unimproved grassland is the main habitat for the small copper, particularly where the main larval foodplants, common sorrel *Rumex acetosa* and sheep's sorrel *R. acetosella*, occur. Though widespread in London, nearly a third of transect sites had zero counts, while other sites recorded counts in low numbers. Larger numbers were present at sites with areas of suitable grassland

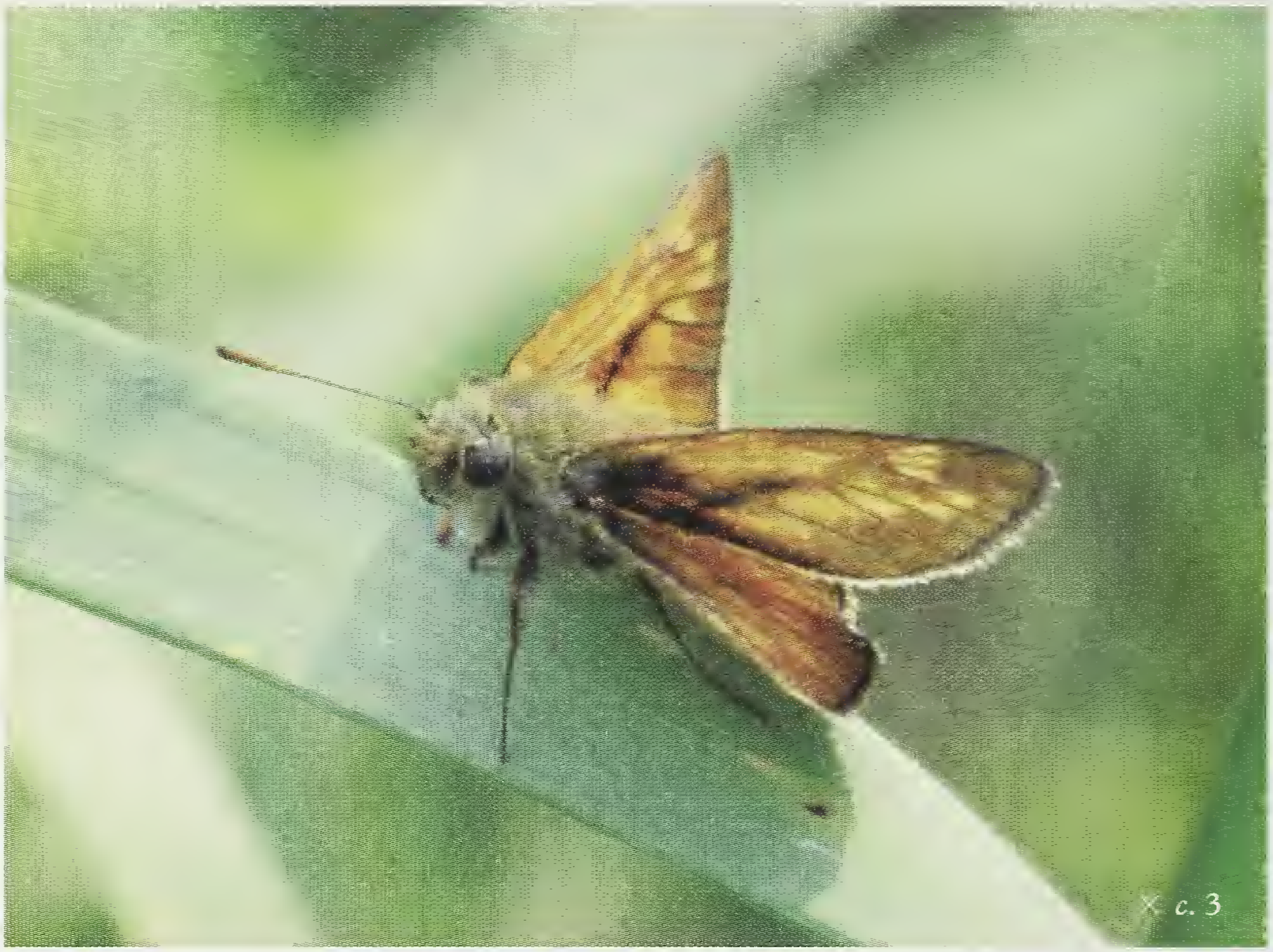


FIGURE 1. Large skipper, Brent Reservoir. *Photo: Roy Beddard*

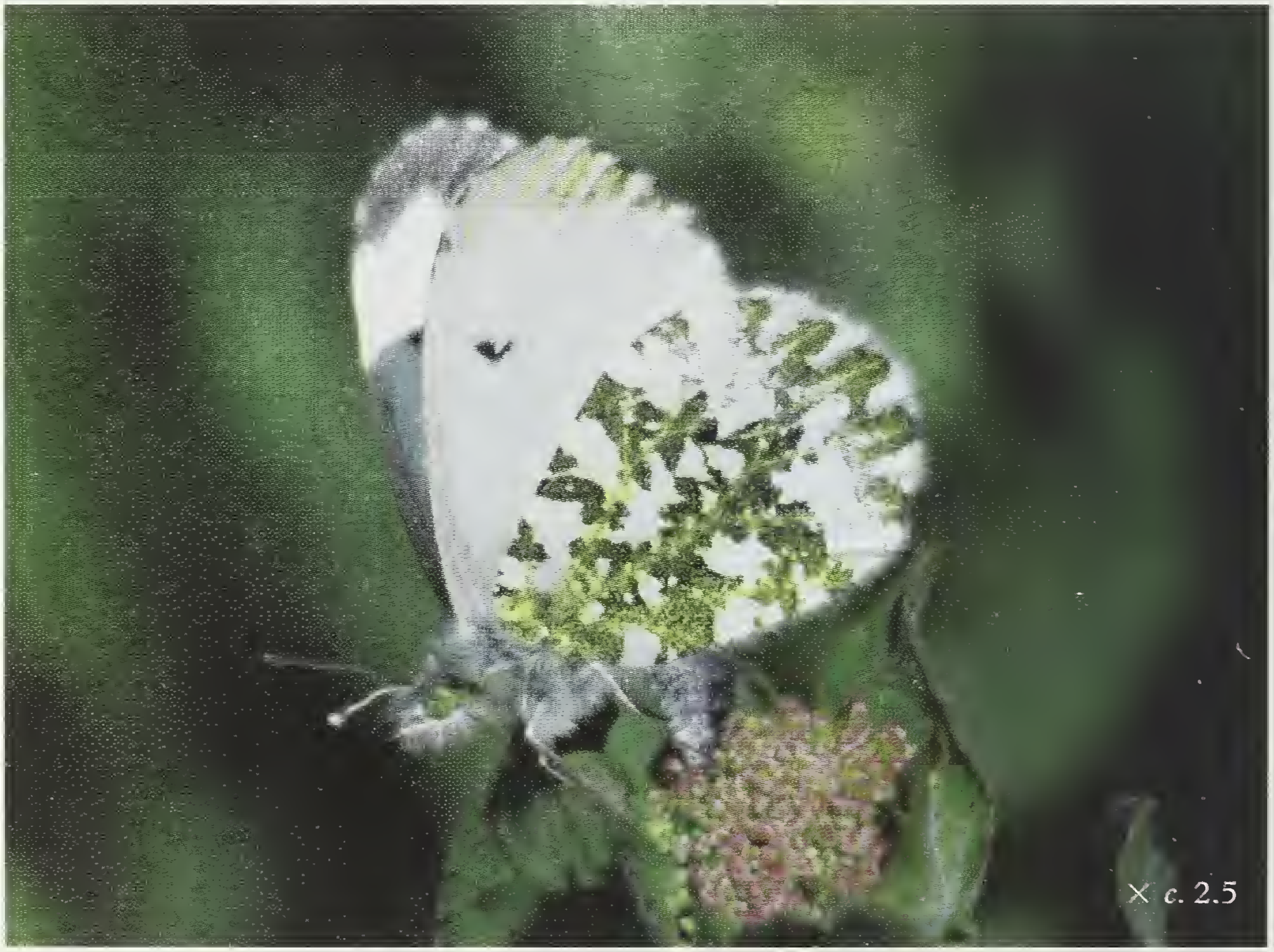


FIGURE 2. Orange tip, Brent Reservoir. *Photo: Roy Beddard*

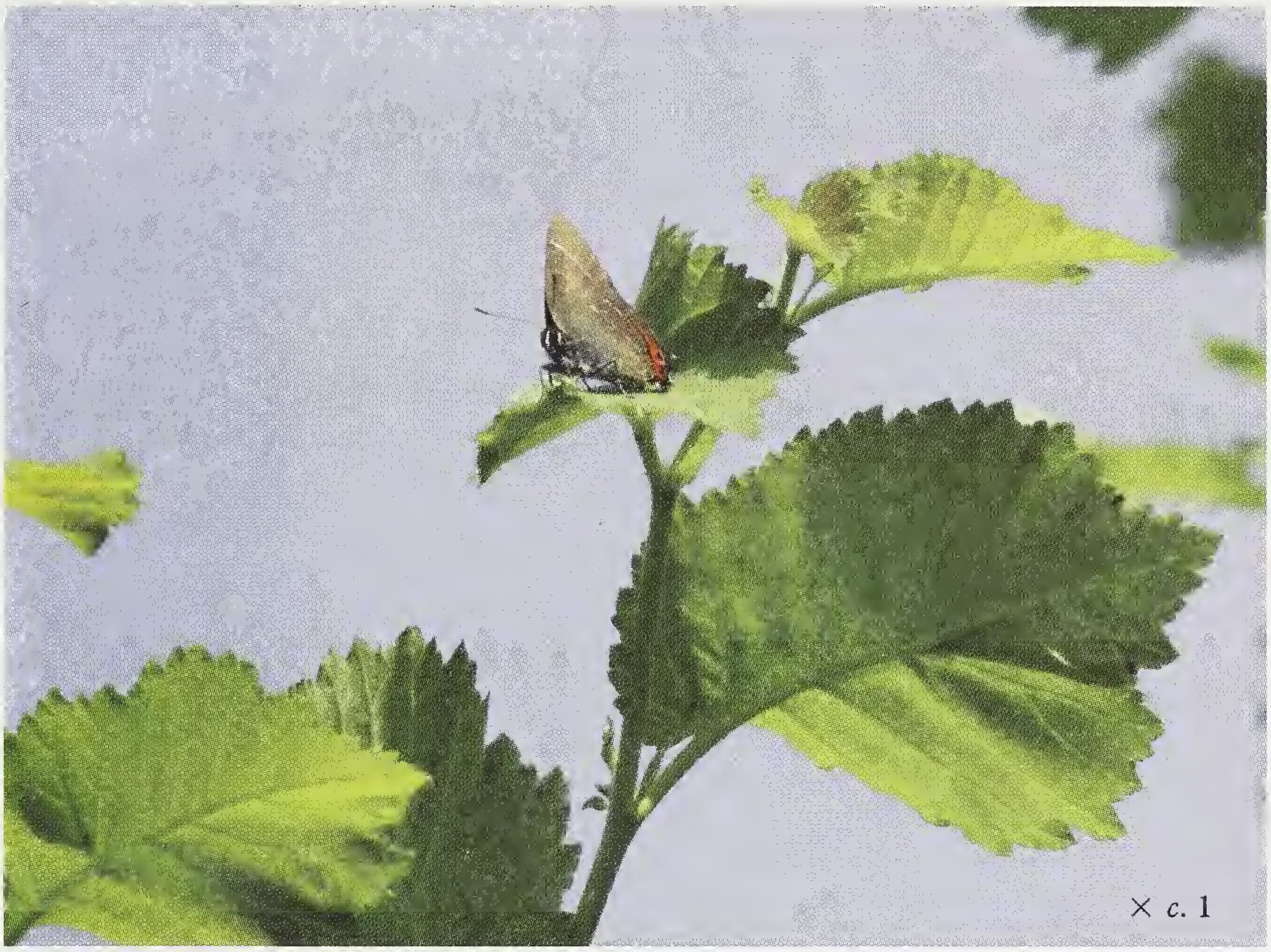


FIGURE 3. White-letter hairstreak on elm. Horsenden Hill. *Photo: David Howdon*

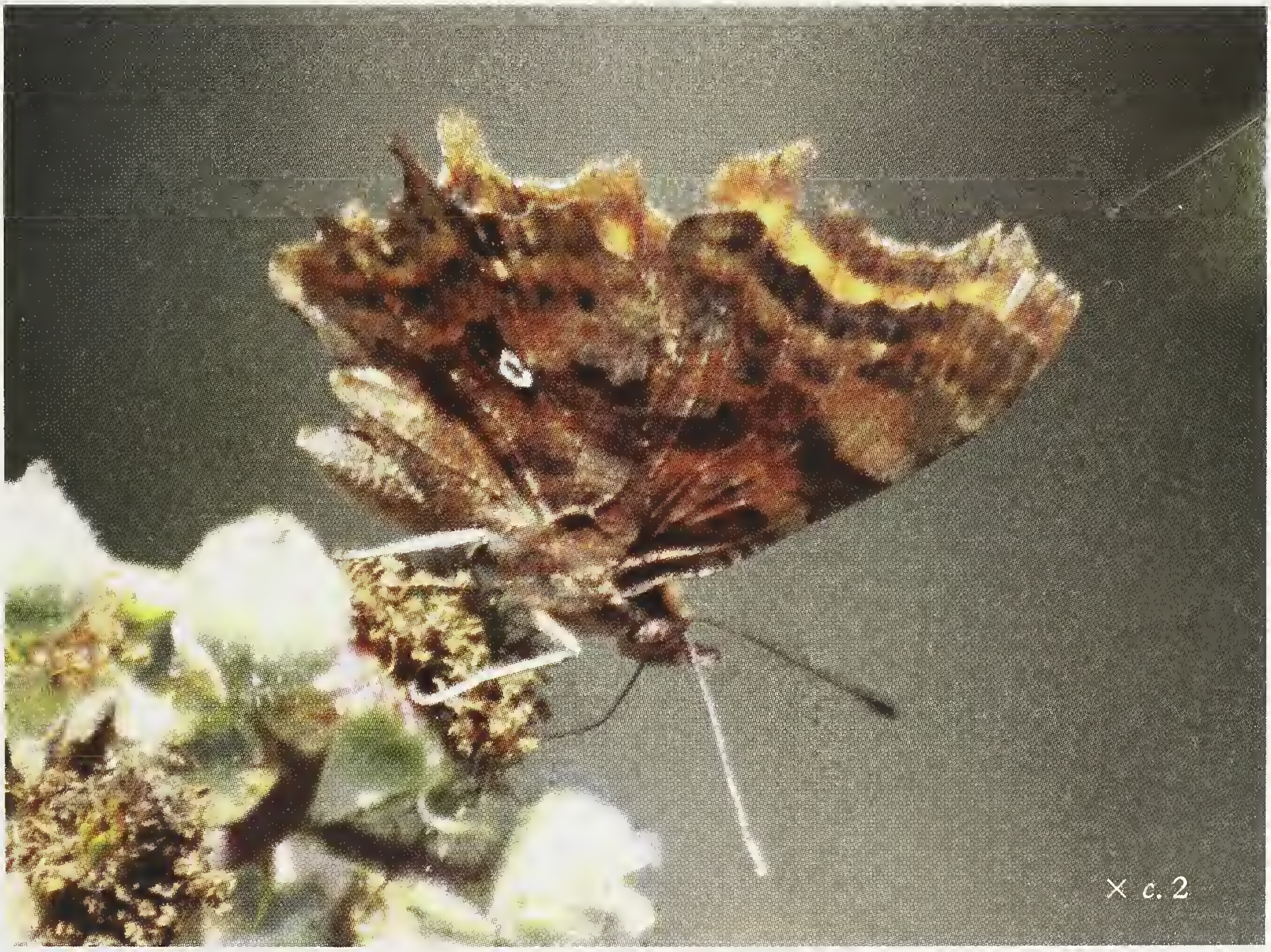


FIGURE 4. Comma on bramble, Brent Reservoir. *Photo: Roy Beddard*

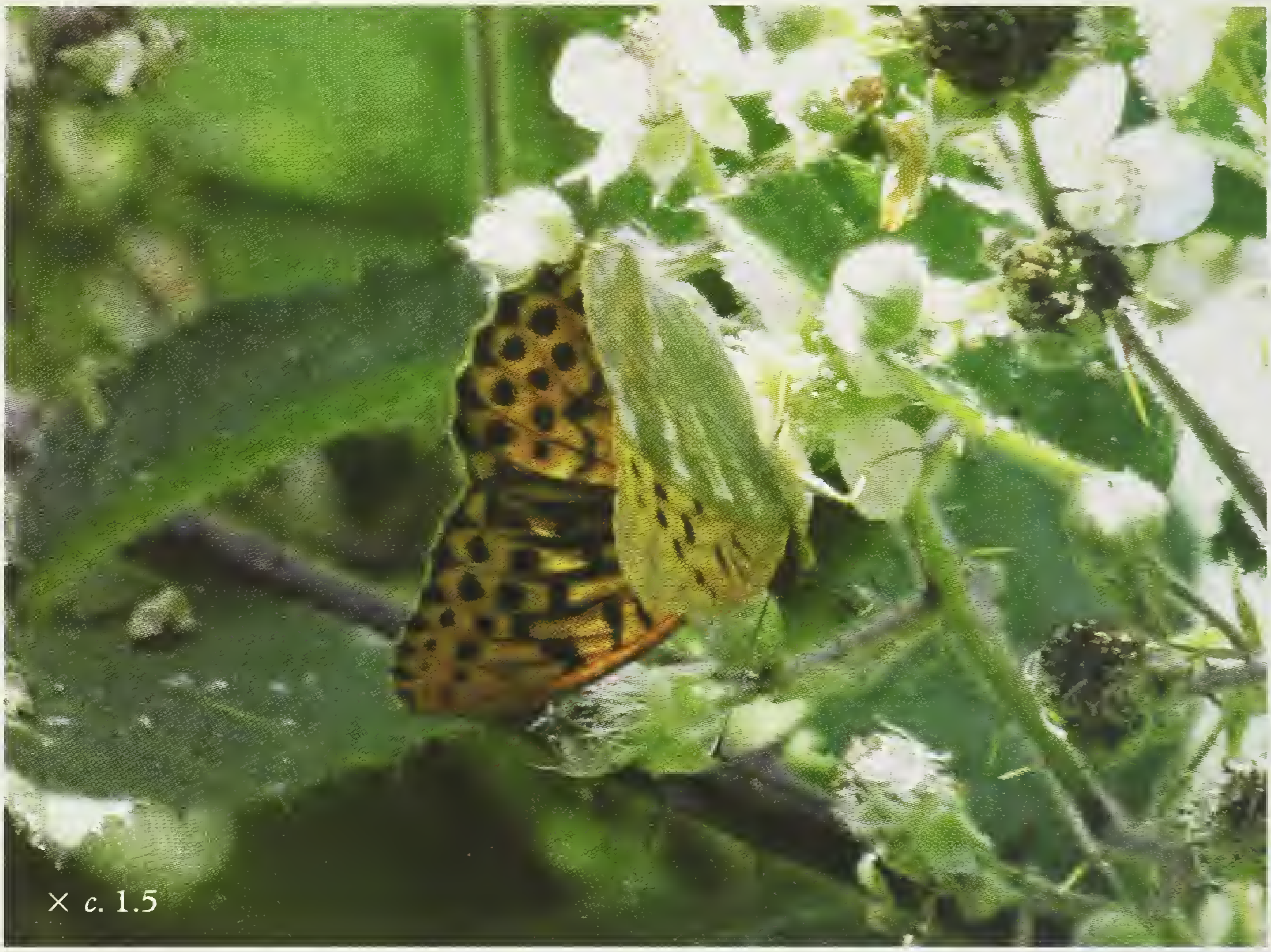


FIGURE 5. Silver-washed fritillary on bramble, Oakhill Park, East Barnet.
Photo: Roy Beddard

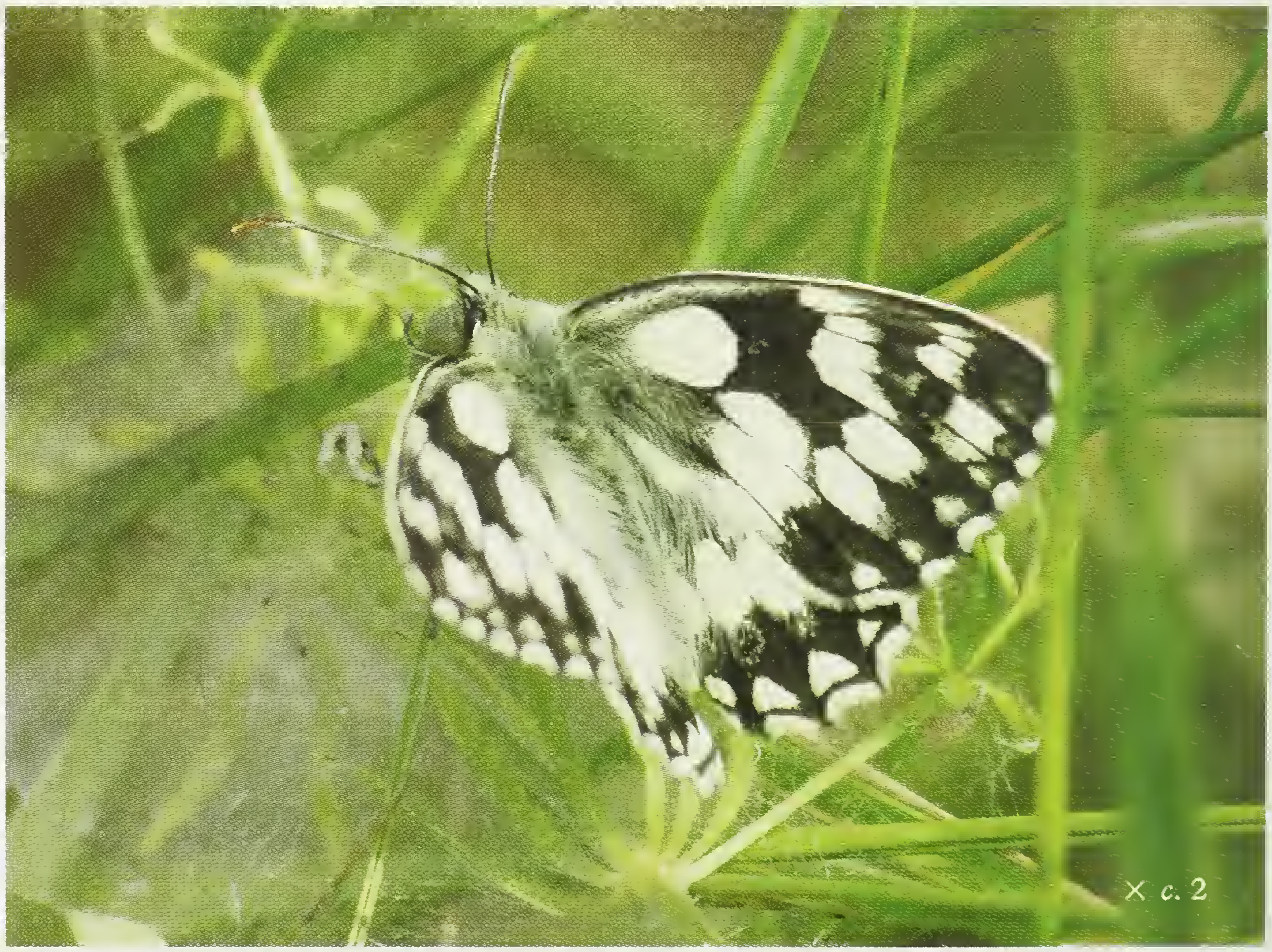


FIGURE 6. Marbled white, Brent Reservoir. *Photo: Roy Beddard*

habitat as at the Horsenden Hill transects, Cranford Park, Kenwood Estate, Mitcham Common, and Farthing Downs. Though there have been no transect records on the Fryent Country Park transects since 2004, one was recorded away from the transect in 2010. Total count on transects: 272.

SMALL BLUE *Cupido minimus*

The small blue is dependent upon the sole foodplant, kidney vetch *Anthyllis vulneraria*, and in London is effectively confined to chalk downland sites on the southern edge of the area. In 2010 it was recorded at three sites over chalk, with almost all of the count from Hutchinson's Bank Nature Reserve and where the highest count since monitoring commenced there in 1997 contributed to the high index for the year. Total count on transects: 116.

BROWN ARGUS *Aricia agestis*

While calcareous grassland is considered to be the typical habitat, the brown argus also occurs on other dry grasslands. In 2010, there was a large increase at a number of sites including Bedfont Lakes (though not included in the index calculations for 2010), Mitcham Common route A, New Hill and Hutchinson's Bank Nature Reserve, which contributed to the highest index since 1997. Away from the transects it was recorded at Perivale Wood, where it has not previously been recorded on the eponymous transect. Total count on transects: 58.

COMMON BLUE *Polyommatus icarus*

The common blue is a species of grassland habitats and the main foodplant is common bird's-foot trefoil *Lotus corniculatus*, though some other legume species are also used. In London it was widespread in 2010, but with the larger populations on chalk downland and other grassland sites. The index was the highest since 2003. Total count on transects: 1,614.

CHALKHILL BLUE *Polyommatus coridon*

Calcareous grassland with the foodplant, horseshoe vetch *Hippocrepis comosa* is the habitat of the chalkhill blue. In 2010 it was recorded at two transects on chalk: Riddlesdown and Hutchinson's Bank Nature Reserve. Total count on transects: 6.

HOLLY BLUE *Celastrina argiolus*

The holly blue is a widespread species dependent upon the presence of the larval foodplants, particularly ivy and holly. As such it is the blue butterfly that can best adapt to urban areas, and though within London the demarcation of 'urban' and 'countryside' is more a mosaic, counts in 2010 were highest at some of the more-urban transects. However, the holly blue was not recorded at some urban sites, for example the Regent's Canal towpath, while a relatively large population was present at Tower Hamlets Cemetery Park. Populations vary from year to year, and the index was almost twice as high as in 2009. Total count on transects: 325.

WHITE ADMIRAL *Limenitis camilla*

The white admiral is a butterfly of woodland and uses honeysuckle *Lonicera periclymenum* as the foodplant. In 2010 one was recorded on the transect at Spring Park. Gay Carr recorded two at Wimbledon Common on 1 July 2010 and singletons on 6 and 10 July 2010; and Martin Smith recorded two at Ruislip Lido on 19 July 2010 and five on 29 July 2010. Total count on transects: 1.

PURPLE EMPEROR *Apatura iris*

The habitat of the purple emperor is broad-leaved woodland where goat willow *Salix caprea* or grey willow *S. cinerea* occur, and it prefers larger woodlands or a landscape with many smaller woods and scrub. Records were made at Addington Hills, Croydon; and see Wood (2011) for records from Park Wood, Ruislip and the populations in the Enfield and south-east Hertfordshire area. Total count on transects: 0.

RED ADMIRAL *Vanessa atalanta*

A migratory butterfly from Continental Europe and North Africa, the red admiral is widespread. It will seek out areas with plants in flower to provide nectar for the adults, and in the spring, females lay eggs on nettles, the young butterflies of which emerge in about July. In 2010 numbers were similar to those of 2008–2009 and below average compared with the past decade. Taking records from all sources, adult red admirals were recorded in London in 2010 in each month from February to December. Total count on transects: 144.

PAINTED LADY *Vanessa cardui*

A migrant from North Africa, the painted lady may occur in any habitat and will seek thistles as nectar sources and as the larval foodplant. After the large migration of 2009, numbers returned to lower figures. Total count on transects: 16.

SMALL TORTOISESHELL *Aglais urticae*

The small tortoiseshell occurs in a wide range of habitats including urban areas, and will seek the common nettle *Urtica dioica* and the small nettle *U. urens* as larval foodplants. Though the index figures indicate an increase for the second year, the numbers remained low and the years 2007–2010 represent the lowest populations since monitoring commenced in London in 1978. Small tortoiseshells were recorded on twelve of the twenty-five transects. Transects south of the Thames recorded the large majority of the count from transects, whilst Wood (2011) reported a decline compared with 2009 for the collective area of Middlesex and Hertfordshire. Total count on transects: 91.

PEACOCK *Inachis io*

Woodland paths, hedgerows and gardens are typical habitats for the peacock though they may occur in other habitats, seeking nectar plants or the common nettle *Urtica dioica* for egg laying. Numbers were lower at most transects in 2010 compared with 2009. Total count on transects: 744.

COMMA *Polygonia c-album* (Figure 4)

The comma has a preference for hedgerows, woodland edges and gardens but may also be found in other habitats, seeking the main foodplants. Recorded on all of the London transects in 2010 though the index was approximately half that of 2009. Total count on transects: 435.

DARK GREEN FRITILLARY *Argynnis aglaja*

The dark green fritillary is a butterfly of grasslands, light scrub and other open habitats. Various species of violet *Viola* spp. are the larval foodplants. Two were recorded at Hutchinson's Bank Nature Reserve. A short distance beyond Greater London but within the LNHS recording area, approximately 400 dark green fritillaries were observed, probably shortly after they had emerged, at Lullingstone Park Golf Course, Eynsford, Kent. Total count on transects: 2.

SILVER-WASHED FRITILLARY *Argynnis paphia* (Figure 5)

The silver-washed fritillary has a preference for broad-leaved woodland in which the common dog-violet *Viola riviniana* grows, though the adult butterflies are typically found along sunny paths and in glades. In recent years there have been records from greenspaces in urban London. The 2010 index reflects the four records from Tower Hamlets Cemetery Park and one at Hutchinson's Bank Nature Reserve. There were also records from Wimbledon Common; Oakhill Woods, Barnet; and see Wood (2011). Total count on transects: 5.

SPECKLED WOOD *Pararge aegeria*

Typically found along paths and in glades in woodland flying in the dappled sunlight of the partial shade, the larval foodplants are various grasses. In the 1980s (Plant 1987) and early 1990s it spread from the south to colonize much of urban and north London; and is now one of the most widespread and common butterfly species in London. The 2010 index was lower than the record high of 2009. Total count on transects: 1,897.

MARBLED WHITE *Melanargia galathea* (Figure 6)

Unimproved, rough grassland preferably containing red fescue *Festuca rubra* and also other grasses provides suitable habitat. In London the marbled white was primarily a species of chalk downland sites but populations have established elsewhere, for example at the Brent Reservoir and Horsenden Hill, while there was one record from Railway Fields. Total count on transects: 322.

GATEKEEPER *Pyronia tithonus*

Two English names for this species, gatekeeper and hedge brown, aptly describe the typical habitat of hedgerows, woodland edges and paths, and other areas with rough grassland and scrub. In the 1980s (Plant 1987) the species had an approximately circum-London distribution but has since colonized more urban areas. In areas of north-west London for example, this colonization appeared to commence in the early 1990s and populations established in the mid to late 1990s. The gatekeeper has become one of the more common species in London and can now often be seen in parks, gardens and other green spaces. In 2010 it was recorded on all transects, and as much in greenspaces within urban London as in the countryside areas. Total count on transects: 2,743.

MEADOW BROWN *Maniola jurtina*

The meadow brown prefers more-open areas than the hedge brown where it requires rough grassland or hay meadows, the management of which is conducive to the growth of the larval grass foodplants. Numerically the most common species recorded from transects in London, that is to some extent a reflection on the predominance of transect recording at nature conservation sites; and it is less likely than the gatekeeper to be seen in urban areas. In 2010 it was recorded on all transects. Total count on transects: 4,096.

RINGLET *Aphantopus hyperantus*

The ringlet is a species of rough grassland in and near to woodland. In 2010 it was recorded on half of the transects and particularly the sites with chalk grassland on the southern edge of London. There was some evidence that it was colonizing some greenspaces in urban London. The count at the Brent Reservoir increased from zero in 2008 to 16 in 2009 and 55 in 2010. There was an increased index at Cranford Park. The three on Horsenden Hill West were the first for that transect; while the London Wetland Centre recorded one, the first on that transect since butterfly monitoring commenced there in 1996. On 4 July 2010, Michael Berthoud recorded one away from the transects but near to the Beane Hill and Fryent Country Park transects — the first record of a ringlet at Fryent Country Park and where the transects commenced in 1986. There were also records from several sites in Barnet, Alexandra Park, and at Wimbledon Common. Total count on transects: 837.

SMALL HEATH *Coenonympha pamphilus*

The small heath occurs in short, well-drained grasslands, where the larval foodplants of fine-leaved grass species occur. However, the evidence suggests that the small heath has became much less widespread in London than it was in the 1980s (Plant 1987), while it had also declined in abundance at several transect sites. Recent records tend to be confined to areas of suitable grassland, for example on chalk sites on the southern edge of London and areas of acid grassland. Transect records in 2010 were from Cranford Park, Hutchinson's Bank Nature Reserve, Farthing Downs, New Hill, Riddlesdown Quarry and at Bedfont Lakes. Non-transect records included Trent Park. Total count on transects: 256.

Discussion

An article by Phil MacMurdie (2010) reported on a trial transect of a highly urban area covering parts of the Liverpool Street and Barbican areas in the City of London, EC1 and EC2. The area had few green spaces though the route attempted to walk through green spaces where they existed. The small white was the most frequent butterfly (52 records), followed by the large white (33), holy blue (14), green-veined white (10), peacock (4), comma (3), red admiral (3) and small tortoiseshell (2). It was noted that there were no skippers or browns. A comparison with nearby transects suggests that the presence of 'nature areas' with small areas of suitable grassland may account for the presence of the gatekeeper and meadow brown on the Regent's Canal towpath from Mile End Road to Mare Street transect a few kilometres to the east, while the presence of a wider range of habitats within an urban area, as at Tower Hamlets Cemetery Park provided for additional species.

For an overview of changes in the distribution and abundance of butterflies within the London area in the two decades since the work of Plant (1987), see Fox and Williams (2006). Trends in the abundance of butterfly species throughout the UK between 1976 and 2009 are summarized in Botham et al. (2010).

Acknowledgements

Ann Rix retired from the Gutteridge Wood transect at the end of 2010 having walked the transect for twenty-one consecutive years. The other transect walkers in 2010 were Richard Payne at Hampstead Heath; Michael Berthoud, Simon Mercer and Leslie Williams at Fryent Country Park and Beane Hill; Andrew Scott, Rachel Thornley, Barry Gutteridge, Gill Peachey, Jo Osmond, Lizzie Bruce, Matt Johnson and Luke Barley at the Corporation of London sites on the southern edge of London (Coulsdon, Farthing Downs, Kenley Common, Riddlesdown, Riddlesdown Quarry, Farthing Downs New Hill, and Spring Park); Martin Boyle and team at the Mitcham Common transects; R. J. Bullock at WWT Wetland Centre at Barn Elms; Catherine Price, Rebecca Turpin, Luke Beman and David Bevan at Railway Fields; Martin Wills at Hutchinson's Bank Nature Reserve; John Grayley, N. O'Connor, Alison Shipley and A. Biggs at Cranford Park; Malcolm Bridge at South Norwood Country Park; Terry Lyle at Tower Hamlets Cemetery Park; Andy Brown at Gunnersbury Triangle; Andrew Self, Roy Beddard and Andrew Verrall at the Brent Reservoir; Donald Rooum at Regent's Canal and Mile End Road to Mare Street; Mike Taylor at Kenwood Estate; David Howdon, Andrew Culshaw and Martin Smith at Horsenden Hill East and West and at Perivale Wood; Richard Featherstone and Jen Hartland at Bedfont Lakes; and Oliver Halford at Bronzefield.

Records were also received from Neil Anderson, Diane Andrews, John Barrington, Fay Broom, Gay Carr, Keith Chambers, Andy Culshaw, Peter Edwards, Oliver Halford, Martin Honey, David Howdon, Bob Husband, Joan Lowe, Keir Mottram, Debbie Pledge, Joan Pryer, Mile Roberts, Chris Rose, Ernie Thomas, Martin Smith, Martin Wills: and from London Natural History Society field meetings / LNHS *Newsletter*, and the Butterfly Conservation Hertfordshire and Middlesex Branch *Newsletter*. The support of the landowners and land managers of the transect and other sites are acknowledged including a significant number of the London boroughs (see the Methods), the Corporation of London, other public authorities, the London Wildlife Trust, the Mitcham Common Conservators, the Friends of Tower Hamlets Cemetery Park, Barn Hill Conservation Group and the Welsh Harp Conservation Group. The co-operation with the county coordinators for Butterfly Conservation is noted, in particular from Andrew Wood for Hertfordshire and Middlesex, and Richard Donovan for Surrey. Dr Dave Dawson had previously advised on the statistical method for the collations and the programming of the spreadsheets. Simon Mercer helped develop the series of linked spreadsheets.

References

ASHER, J., WARREN, M., FOX, R., HARDING, P., JEFFCOATE, G. and JEFFCOATE, S. 2001. *The millennium atlas of butterflies in Britain and Ireland*. Oxford University Press.

BOTHAM, M.S., BRERETON, T.M., MIDDLEBROOK, I., CRUICKSHANKS, K.L., ZANNESE, A. and ROY, D.B. 2010. *United Kingdom Butterfly Monitoring Scheme Annual Report for 2009*. CEH, Wallingford.

CRAWFORD, T.J. 1991. The calculation of index numbers from wildlife monitoring data. *In* Goldsmith, B. (ed.), *Monitoring for conservation and ecology*: 225–248. Chapman and Hall. London.

FOX, R. and WILLIAMS, L. 2006. A commentary on recent changes to butterfly distributions in the London Area. *Entomologist's Rec.J. Var.* **118**: 69–84.

MACMURDIE, P. 2010. City transect. *Hertfordshire and Middlesex Branch of Butterfly Conservation Newsletter* **60**: 4–7.

PLANT, C.W. 1987. *The butterflies of the London Area*. London Natural History Society.

POLLARD, E. and YATES, T.J. 1993. *Monitoring butterflies for ecology and conservation*. Chapman & Hall, London.

ROY, D.B. and ROTHERY, P. 2002. Comparison of the BMS (chaining) and TRIM (log-linear) methods for the calculation of collated indices. *In* Greatorex-Davies, J.N. and Roy, D.B. 2002. *The butterfly monitoring scheme. Report to recorders 2001*. Centre for Ecology & Hydrology. Natural Environment Research Council.

WILLIAMS, L.R. 2000. London butterfly monitoring report for 1999. *Lond. Nat.* **79**: 87–102.

WOOD, A. 2011. *Hertfordshire & Middlesex butterflies*. Hertfordshire and Middlesex branch of Butterfly Conservation.

Book reviews

Developmental biology. A very short introduction. Lewis Wolpert. Oxford University Press. 2011. 132 pp., 172 × 110 mm, softback. ISBN 978 0 19 960119 6. £7.99.

The animal kingdom. A very short introduction. Peter Holland. Oxford University Press. 2011. 126 pp., 172 × 110 mm, softback. ISBN 978 0 19 959321 7. £7.99.

Although this Very Short Introduction series hasn't come our way before, it was started in 1995 and now numbers 300 volumes. All are written by experts and have been published in more than twenty-five languages. The VSI Library covers a wide variety of topics in history, philosophy, religion, science and the humanities.

In ***Developmental biology,*** distinguished developmental biologist Professor Lewis Wolpert takes us from the earliest scientific approach on development of the embryo starting with Hippocrates in Greece in the fifth century BC, and followed by Aristotle a century later, through the vertebrates, invertebrates and plants to morphogenesis, to organs, the nervous system, to growth, and cancer and ageing. The final chapters are regeneration and evolution.

In ***The animal kingdom,*** Linacre Professor of Zoology at the University of Oxford, Peter Holland, describes how our understanding of animal biology has been greatly enhanced in recent years by analysis of DNA and the study of evolution and development. We are presented with a modern tour of the animal kingdom, beginning with the definition of animals through to the high-level groupings and new views on evolutionary relationships, together with an overview of the biology of each group of animals. As well as being of great value to all students of the life sciences, a concise summary is provided for the interested general reader.

As these are small books, and the chapters are short, the topics are easy to follow and look back over without losing the thread.

Recent comments on the series enlarge upon this idea as the books can be popped into your pocket to dip into in spare moments; and can even be ranked as the thinking reader's Wikipedia.

K. H. HYATT

Odonata report for 2010

NEIL ANDERSON
52 Beechwood Avenue, Greenford, Middlesex UB6 9UB

We were blessed with some fine warm weather through late spring and up to midsummer which provided many good opportunities for Odonata activity and observation. Until late summer it was one of the driest years on record which did result in some water bodies drying up. This was noted at Bookham Common, with the stream crossing Bayfield Plain being dry for the first time in the years that I have visited.

The London Wetland Centre (LWC) has now recorded seventeen species of Odonata breeding (at least ovipositing) on the site — a number which is nationally significant. Hairy dragonfly *Brachytron pratense* has been recorded as individuals for several years now. This species is considered nationally scarce but is increasing its range. The first record at LWC this year was of one by Steve Pash on 1 May. From 18 May it was recorded almost daily until the end of the month with a minimum of two males and a female seen on any day. A female was recorded ovipositing around the Entrance Lake edge on 25 May for the first time at LWC. On 23 May a male flew into the staff kitchen where it was photographed. The largest populations of this species in our area remain to the east in the Lea Valley, particularly around Cornmill Meadows, and in Epping Forest. Colin Jupp recorded a male hairy dragonfly at Bedfords Park, near Romford, on 11 June. Four-spotted chaser *Libellula quadrimaculata* was also recorded ovipositing at the LWC for the first time this year.

For the second consecutive year downy emerald *Cordulia aenea* was reported from LWC , this being recorded by four visitors. I also recorded, with Kathryn Bull, an individual patrolling an area by the main lake at Kew Gardens on 30 May. Another record from south-west London/Surrey was of one seen in Bushy Park by Chris Alger. This is another species that may be showing some signs of expansion. The best known colonies in our area are based in Epping Forest and on Esher Common. Brian Spooner, an eminent mycologist/general naturalist, relayed his concerns to me about dredging works that were executed at Black Pond on Esher Common which may have had a detrimental effect on the aquatic fauna there. This site is usually reliable for both downy and brilliant emeralds *Somatochlora metallica* but Steve Spooner (unrelated to Brian) informed me he was unable to find the latter species this year for the first time. He hopes to report back next year to see if either of these scarce emerald species can be found in 2011 at Black Pond.

LWC appears to be the local hot spot for seeing the migrant lesser emperor *Anax pathenope*. This was first recorded in the UK in 1996; a predominantly southern species, which has been recorded in small numbers on an annual basis since, with breeding activity recorded in a few locations (not in the LNHS area). The first LWC record of this species was in 1999 and accepted by the British Dragonfly Society rarity panel. It has also been recorded here in 2008/9. Dr Richard Bullock found a male this year in World Wetlands on 29 June and probably the same individual was observed the following day by Nick Senior. Away from LWC another record was of an individual hawking along the lake in Black Park, seen by Pete Naylor.

No records have materialized this year of one of our more regular migrants red-veined darter *Sympetrum fonscocolombii*, after several in 2009.

One of the most interesting records of the year was identified retrospectively. Stuart Cole had photographed a dragonfly in Bushy Park, which at the time he had tentatively identified as a male black-tailed skimmer *Orthetrum cancellatum*. On inspection of his photograph on his computer screen later, he realized his mistake and sent me his record shot which he had correctly reidentified as a male scarce chaser *Libellula fulva* (Figure 1). The original observation of this scarce chaser was made on 8 June which represents the first record of this species in the LNHS recording area — so a very exciting discovery for Stuart!

Scarce chasers are a Red Data List species though in recent years there has been a noted expansion in range. It can be abundant in its core sites on river systems in East Anglia and southern England and in recent years has colonized parts of the Wey in Surrey, probably the nearest breeding location to our area. With this expansion of range perhaps we will see more records of this scarce species. Bushy Park is an interesting site for Odonata with beautiful and banded demoiselles and white-legged damselflies *Platycnemis pennipes* recorded here too.

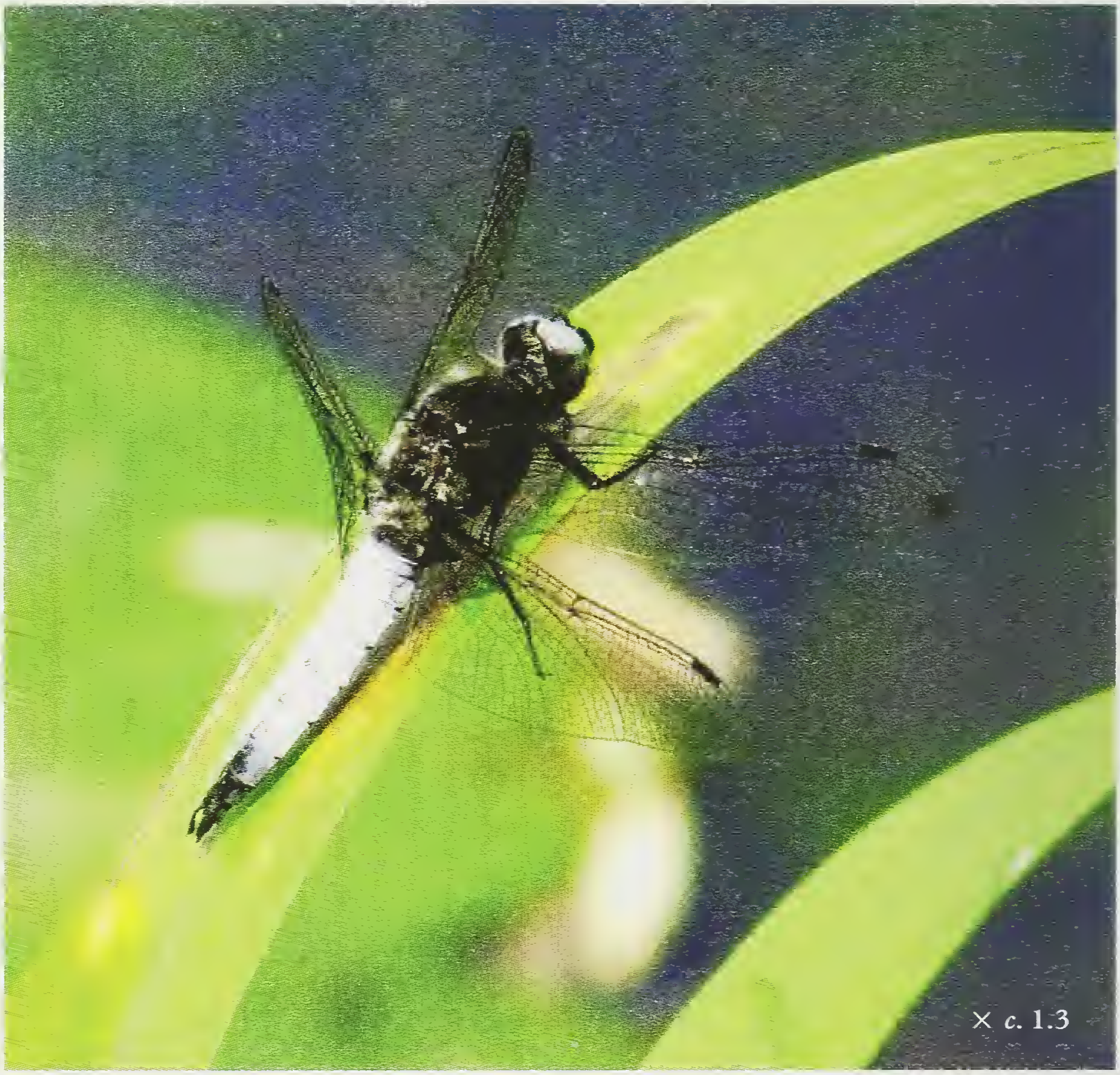


FIGURE 1. Male scarce chaser, Bushy Park, 8 June 2010. *Photo: Stuart Cole*

Just outside our recording area some phenomenal events unfolded this year. First was the rediscovery of a species considered extinct in the UK since 1953 when inundation of seawater flooded the only known site near Benfleet of the dainty damselfly *Coenagrion scitulum*. This species was rediscovered last year in Jersey, but this year four individuals were discovered by John and Gill Brooks in north Kent on the Isle of Sheppey. Nearby at another site they also found two exuviae which were confirmed to be of this species, so hopes are high for a recolonization of the dainty damselfly.

The next excitement was of a species first recorded in the UK in 2002 — the southern emerald damselfly *Lestes barbarus*. Just outside our area up to three were recorded at Cliffe Marshes RSPB reserve, Kent on 17 July. The species continued to be recorded here until early August. A single individual was also recorded north of the Thames at Wat Tyler Reserve, Essex. One to watch out for here as it has expanded on the near Continent.

In my 2009 report I mentioned the apparent establishment of another lestid, willow emerald *Lestes viridis*, in Suffolk last year after its initial discovery in 2007. This year has seen strong numbers again, but excitingly it has now been recorded at two sites just outside our region near Reculver, Kent. Two males and a female were located on 28 August, up to fourteen individuals with a minimum of two females on 12 September and on 18 September nine were counted with a pair observed in tandem. Another one to watch out for in the next couple of years.

The final excitement was of a species recorded only four times previously in the UK — the southern migrant or blue-eyed hawker *Aeshna affinis*. The first record was as long ago as 1952 in Kent with a further three records in 2006. On 20 July several were recorded at Hadleigh Country Park, near Benfleet, Essex. On the 24 July there were around ten individuals — eight mature males, an immature male and a female present. The following day a pair was also located at Cliffe, Kent. By early August several southern migrant hawkers were still at Hadleigh with four males, two coupled pairs and one seen ovipositing in some dry mud. It is with eager anticipation that we await next year's season to see if this was a one-off event or possibly the beginnings of a new colonization. Will the coldest December for over a century have had a deleterious effect? With range expansions of our native species, and new species arriving, these are very exciting times for students of Odonata.

The small red-eyed damselfly *Erythromma viridulum* is the most successful of the recent colonists, now widespread in our area after its initial sighting in the UK in 1999. Colin Jupp commented that in Bedfords Park LNR, near Romford, numbers this year were the lowest since the initial colonization of this site in 2000–2002. During 2002–2004 counts were in four figures. However, he also mentions poor numbers of most species here so the cause may be local. He did discover a probable new colony at Sutcliffe Park, Lewisham where twenty or more were noted on 6 July. I have continued to record small numbers of this species alongside its larger cousin at one of my study sites — Lime Trees Park Golf Course in Northolt. This site has several ponds of various vintage and is possibly the richest Odonata site in the London Borough of Ealing with sixteen species recorded. Andrew Culshaw recorded six of this species on one of the nearby Horsenden Hill ponds in late July.

In the October *British Wildlife* magazine dragonfly report several recorders were puzzled by low numbers of the normally abundant blue-tailed damselfly *Ischnura elegans*. Generally I would concur with this, but at the golf course study site I counted forty solo individuals and some seventy or more pairs in cop on *Typha* stems on one of the larger ponds in early July, as well as a single male emerald damselfly *Lestes sponsa*, my first record there. Des McKenzie recorded fourteen blue-tailed damselflies on Long Water/Serpentine on 9 June. Other records from this central London location included five broad-bodied chasers *Libellula depressa* on this date and eight emperor *Anax imperator* on 21 July.

Last year I outlined the discovery of a small colony of beautiful demoiselle *Calopteryx virgo* along the stream at Bookham Common. A photo of one here from this spring was posted on the Wild About Britain website; further individuals were observed on his bird walk by Pete Lambert in May, but as mentioned earlier in this report the stream did dry up, yet I still managed to locate one female in the shade on my study day in July. Dr Alan Prowse kindly sent me excellent photos of both a male and a female taken here in 2009

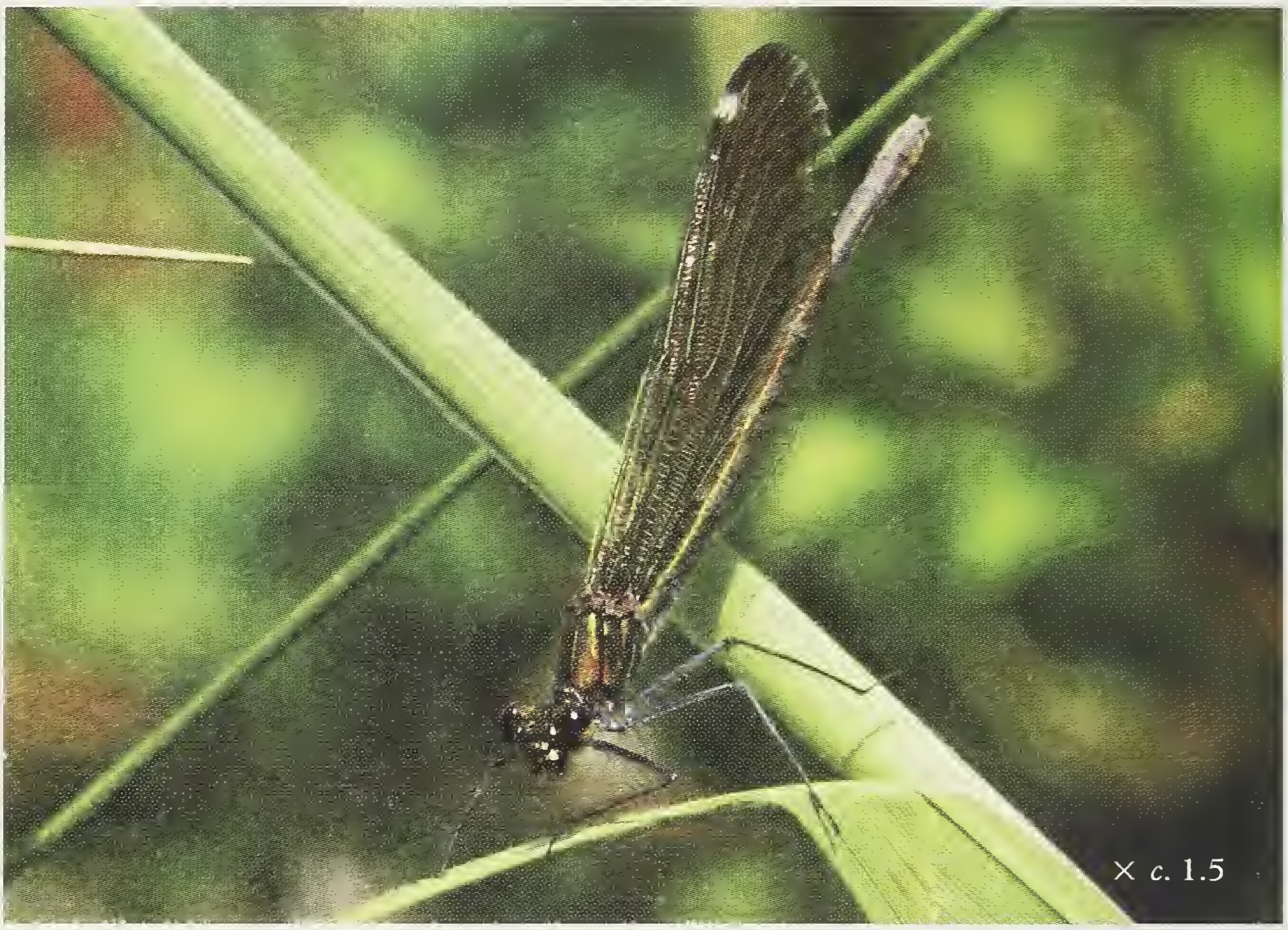


FIGURE 2. Female beautiful demoiselle by stream on Central Plain, Bookham Common, 24 June 2009. *Photo: Alan D. Prowse*

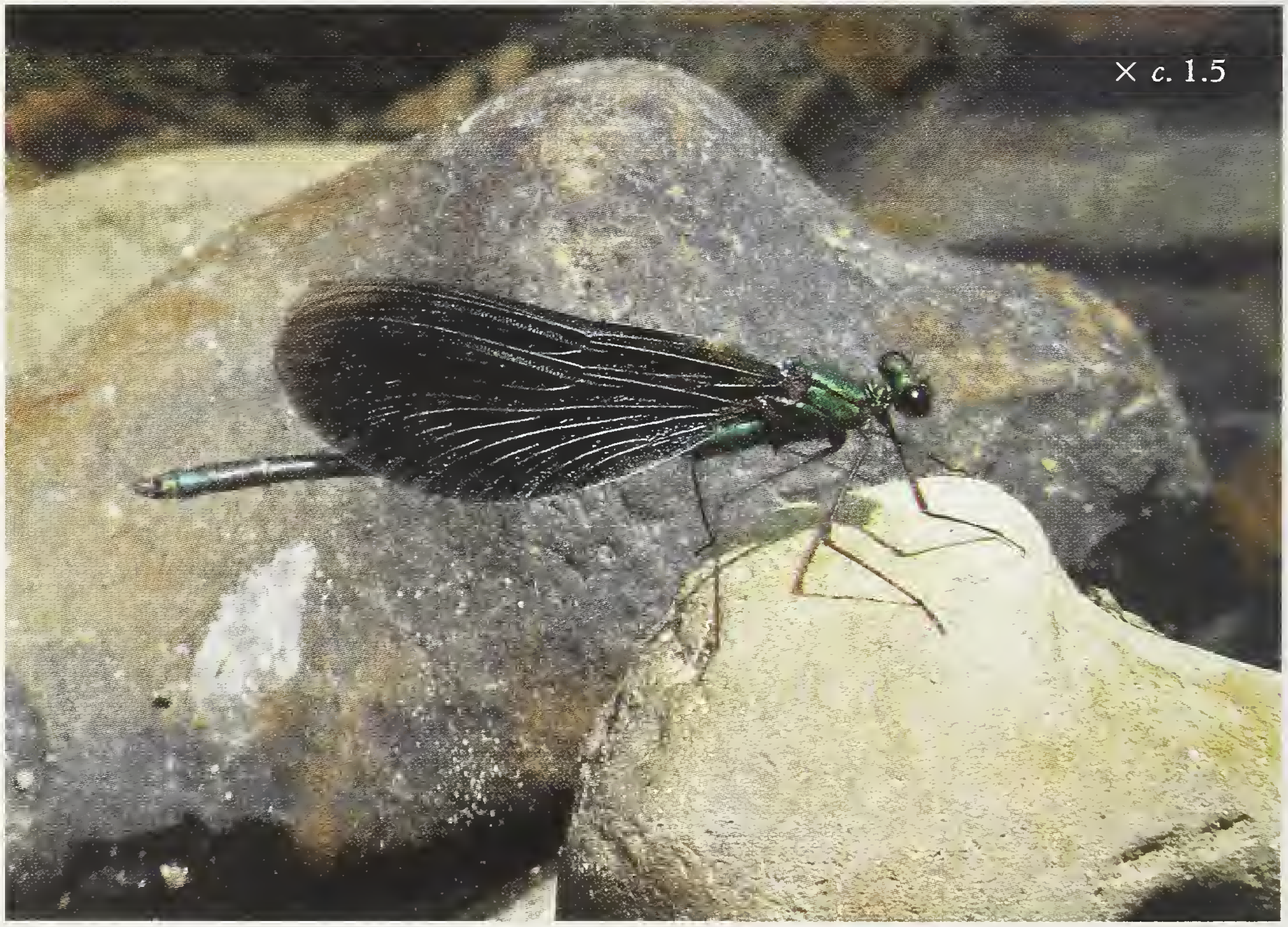


FIGURE 3. Male beautiful demoiselle resting on stones, Central Plain, Bookham Common, 24 June 2009. *Photo: Alan D. Prowse*

(Figures 2 and 3). Other records of this species in our area included an immature male found by Robert Callf along a hedgerow at Vicarage Farm, Enfield on 19 May and some were reported from Bushy Park on 11 June. It will be interesting to see if the dry spell has had a detrimental effect on the possible colonization in the LNHS area.

Thanks to those who have sent records to me and keep observing — these are dynamic times for Odonata. All records are gratefully received and particularly of some of the scarcer, more-local species, migrants and recent colonists.

References and further reading

ANDERSON, N. 2010. Odonata report for 2009. *Lond. Nat.* **89:** 77–78.

CHAM, S. 2010. *Br. Wildlife* **21**(6): 427–430.

PARR, A. 2010. *Br. Wildlife* **22**(2): 125–127.

PERRIN, V. 2010. *Br. Wildlife* **22**(1): 47–49.

SMALLSHIRE, D. and SWASH, A. 2010. *Britain's dragonflies.* Ed.2. WILDguides Ltd, Old Basing, Hampshire.

Book review

History & mystery. Notes & queries from the newsletters of The Society for the History of Natural History. Edited by Charles Nelson. 2011. Softback, 234 × 160 mm, 200 pages. ISBN 978 0 901843 09 8. £15 (UK), £18 (elsewhere), post free, from The Society for the History of Natural History, c/o Natural History Museum, London SW7 5BD.

The Society for the History of Natural History celebrated its seventy-fifth anniversary in 2011. To mark the occasion the Society has produced this fascinating anthology of notes and queries from its *Newsletters*. Naturalists, books, collections, works of art, societies, even a mermaid, are contained here. Some of the notes are witty commentaries, some of the topics are unexpected, even bizarre, and some of the queries are still unanswered.

This is a book to dip into more than just read from start to finish. The headings are diverse: Very proper pronunciation; The business of natural history; Treasures of the deep; Wild animals, obtuse & furry; Criminals as naturalists; Moravian naturalists; Charles Darwin & family; Mysteries!; Misprints: best & worst?; Auctions & sales; Memorials to naturalists — these are just a selection of the contents.

Founded in London in 1936 as the Society for the Bibliography of Natural History, the SHNH welcomes as members everyone with an interest in the history of natural history, natural history collections, exploration, art and bibliography. The Society publishes twice a year an internationally respected journal, *Archives of Natural History*, which contains papers on a wide range of topics from early exploratory travel, biographies of naturalists, marine exploration, and art in natural history, and an informative *Newsletter* (three issues a year) giving, amongst other relevant topics, details of forthcoming meetings, at home and abroad, and notices of ongoing investigations. Some of the meetings are held in conjunction with other societies, indeed, our own 150th anniversary conference in October 2008 was held in association with the SHNH and The Linnean Society of London.

History & mystery is also intended to help replenish funds, especially of the Alwyne Wheeler Bursary which supports travel by scholars to meetings of the Society so that they can make original contributions to the study of the history of natural history.

K. H. Hyatt

Hemiptera report for 2010

TRISTAN BANTOCK
101 Crouch Hill, London N8 9RD

Introduction

Since this is my first report for *The London Naturalist*, I should start by defining exactly which insect groups will be included in these accounts. The Hemiptera is a large and diverse insect order in Britain, containing around 1,600 species and comprising three suborders. My own recording interests cover two of these; the Heteroptera (so-called 'true bugs') and the Auchenorrhyncha (leafhoppers and related families), both of which have historically received much more attention from amateur naturalists than the Sternorrhyncha (aphids, scales, psyllids and whiteflies), which often require specialist techniques for identification and study. Amongst the Heteroptera, most of the shieldbugs and allied species are large, conspicuous and distinctive insects, whilst many of the Auchenorrhyncha are also easily recognized in the field. The last five years has seen an upsurge of interest in these two groups, with a variety of resources now in place to encourage newcomers to start recording these fascinating but frequently neglected insects. These include several published field guides and identification keys, as well as an online identification guide to much of the British fauna (http://www.britishbugs.org.uk). The Heteroptera and Auchenorrhyncha recording schemes now also have dedicated websites (http://www.hetnews.org.uk and http://www.ledra.co.uk), both of which contain a wealth of information and publish newsletters which are available for download.

The British bug fauna has undergone significant changes over the last fifty years, and these have been especially marked during the last decade. A group of previously uncommon species have expanded their ranges by adapting to new habitats or switching to new food plants and over fifty species have been added to the British list. While many of these changes are probably attributable to gradual climatic warming, the increased trade in ornamental plants and landscaping materials from the Continent has been responsible for some of these new arrivals. The Greater London area benefits from a significantly milder climate than other parts of southern Britain and it is pertinent that a number of these new colonists appear to be found nowhere else. As stressed by Max Barclay in his recent review of London's changing beetle and bug fauna, now is an exciting time to record these insects within the capital (Barclay 2009*b*).

It has been some time since a Hemiptera report has featured in *The London Naturalist* and I intend to use this opportunity to provide regular updates regarding the fauna of the LNHS recording area. I am very fortunate to follow in the footsteps of Eric Groves, whose ground-breaking series of papers on the Heteroptera of the London Area spanning 1964 to 1986 (for references see Groves 1986) provides an excellent baseline from which to monitor future changes. Eric was very involved with the Bookham Common Survey and I hope to extend his pioneering work at this site; monthly visits during 2009 and 2010 have so far added eleven new species of Heteroptera and fifteen species of Auchenorrhyncha.

This has been a very interesting year for Hemiptera in the London Area, with a number of significant discoveries. These include the reappearance of *Eremocoris fenestratus*, a bug presumed to be extinct in Britain, as well as the first British records of *Rhyparochromus vulgaris* and the leafhopper *Zygina nivea*.

The ground bug *Eremocoris fenestratus* was historically associated with juniper *Juniperus communis* at a few chalk sites in southern England and was last seen at Coombe Hill in the Chilterns nearly fifty years ago. It was therefore something of a surprise to receive a specimen collected by Edward Milner in the garden of the Quaker Meeting House, Syon Lane, Brentford, which keyed out to this species. After seeking a second opinion and checking the material in the Natural History Museum, I arranged to visit the Meeting House in early September. This yielded five *E. fenestratus* found in litter under a line of yews *Taxus baccata*, as well as a further example under a large cypress *Cupressus* species in nearby Isleworth cemetery. The species is associated with a wide range of plants in Germany, including Cupressaceae, and it thus seems likely that these newly found populations in London originate from Continental Europe. Significantly, photos of *E. fenestratus* have since come to light which were taken in a garden in Twickenham during 2007, suggesting that the bug is well-established in this part of London, and has been there for several years at least. It will be interesting to see how widespread this species proves to be; further details are reported in *Het. News* (Bantock 2010*a*).

Another ground bug, *Rhyparochromus vulgaris,* was reported for the first time in Britain from Rainham Marshes, following the identification of a specimen photographed in May by Howard Vaughan (Nau 2010). This species is widespread on the Continent, preferring damper locations than the closely related *R. pini*. Searches for further bugs have so far proved negative, but I hope to make several visits during 2011. Another interesting record from Rainham was a specimen of *Rhaphigaster nebulosa*, which was photographed there in late September. Since this shieldbug has been expanding its range on the Continent, it is intriguing to speculate whether this represents a locally established population or is simply an isolated vagrant.

The leafhopper *Zygina nivea* was first recorded by Joe Botting, who found a single example at Margravine Cemetery, Hammersmith in February. The second was swept by Sarah Barnes during an LNHS field meeting to the Richmond area in April. Although members of this genus are most frequent during late summer and autumn, it is not unusual to find females overwintering on evergreens. *Z. nivea* is specifically associated with white poplar *Populus alba* and has undergone recent range expansion in Germany, perhaps explaining its appearance in Britain. In late September I was surprised to find the species in abundance on white poplar at Alexandra Park, Hornsey, suggesting that it may already be well-established in the London Area (Bantock et al. 2010)

A significant feature of the year was the continued presence of several non-native species endemic to warmer climates, despite the relatively cold winter of 2009/2010. The southern green shield bug *Nezara viridula* has only recently become established in the UK (Barclay 2004), and its ability to do so is certainly a signal of on-going climate change (Shardlow and Taylor 2004). This species overwinters as an adult, when its survival is strongly limited by winter temperature. Other species such as the leafhopper *Synophrophis lauri*, associated with bay laurel *Laurus nobilis* and the mirid bug *Closterotomus trivialis,* both of which are endemic to the Mediterranean, continue to survive in the London Area, with a new population of the latter coming to light in the Battersea area (Bantock 2010*b*).

The red and black ground bug *Arocatus longiceps* (Nau and Straw 2007, Barclay 2009*a*) is still prolific in central London and appears to be spreading into the suburbs. Its distribution should eventually mirror that of its host, although I swept a single individual at Mitcham Common from field maple *Acer campestre* in September with no London plane *Platanus* × *acerifolia* in the immediate vicinity. Two other recently arrived species also appear to be prospering: the leafhopper *Liguropia juniperi,* now widespread on cypresses and *Dryodurgades antoniae* which is associated with common broom *Cytisus scoparius.* This latter species appeared in the Thames Gateway area of Essex in 2008 and now seems to be moving inland; I found it in Middlesex at Hounslow Heath in September.

Finally, an interesting but not unexpected record was an early instar nymph of the Western conifer seed bug *Leptoglossus occidentalis,* swept from a Scots pine *Pinus sylvestris* on Wimbledon Common during an LNHS field meeting in August. This large squashbug (Coreidae) is surely the most spectacular species of Heteroptera to appear in recent years and is up to two centimetres long when adult, with a reddish-brown body, transverse white zigzag line across the centre of its wings and characteristic leaf-like expansions on the hind legs. Native to western parts of North America, it was first reported in Europe from Italy in 1999, following accidental introduction by sea or air. The species spread remarkably fast, probably aided by repeat introductions, and reached northern France and the Low Countries by 2007. The bug is a powerful flier and colonization of Britain was largely achieved via unassisted dispersal across the English Channel. This phenomenon was first observed during the autumn of 2008, when large numbers of adults reached the south coast of England with a wide scatter of records further inland (Malumphy et al. 2008). This species is now probably well-established in Britain, but is still uncommon and there have been very few reports of the early life stages.

References

BANTOCK, T. 2010*a*. Rediscovery of *Eremocoris fenestratus* in Britain. *Het. News* **2**(16): 6.

BANTOCK, T. 2010*b*. *Closterotomus trivialis* – London update. *Het. News* **2**(16): 9.

BANTOCK, T., BOTTING, J. and BARNES, S. 2010. *Zygina nivea* (Hemiptera: Cicadellidae) new to Britain. *Br. J. Ent. nat. Hist.* **23**: 235–236.

BARCLAY, M. V. L. 2004. The green vegetable bug *Nezara viridula* (L. 1758) (Hem: Pentatomidae) new to Britain. *Entomologist's Rec. J. Var.* **116**: 55–58.

BARCLAY, M. V. L. 2009*a*. *Arocatus longiceps* Stål (Lygaeidae) in Britain, an update. *Het. News* **2**(13): 7.

BARCLAY, M. V. L. 2009*b*. Beetles and bugs in London — a review of a changing fauna. *Lond. Nat.* **88**: 45–53.

GROVES, E.W. 1986. Hemiptera-Heteroptera of the London Area. Part XVI. *Lond. Nat.* **65**: 119–178.

MALUMPHY, C., BOTTING, J., BANTOCK, T. and REID, S. 2008. *Leptoglossus occidentalis* influx in England. *Het. News* **2**(12): 7–9.

NAU, B.S. 2010. A lygaeid and two mirids new to Britain. *Het. News* **2**(15): 1.

NAU, B.S. and STRAW, N. 2007. *Arocatus roeselii* established in Britain? *Het. News* **2**(9): 8.

SHARDLOW, M. and TAYLOR, R. 2004. Is the southern green shield bug, *Nezara viridula* (L.) (Hemiptera: Pentatomidae) another species colonising Britain due to climate change? *Br. J. Ent. nat. Hist.* **17**(3): 143–146.

Book review

Plant galls. Margaret Redfern. New Naturalist No. 117. Collins, London. 2011. 562 pp. Hardback £50, ISBN 978 0 00 220143 8, paperback £30, ISBN 978 0 00 220144 5.

The subject of plant galls is an area of relative inaccessibility, with many individuals unaware of their complexities. They are often perceived merely as the growths on oak that have some sort of connection to wasps. Many people remain unaware of their complexity as a topic of study.

Cecidology, the study of galls, is a very varied subject. Galls have a wide variety of inducing organisms, with complex life cycles, multi-trophic levels of association and complex processes of plant genetic modification. Galls have evolved many times over. They have a long association within human history. Such biological and historical factors result in a topic that is hardly one-dimensional. Misconceptions still exist; this may be in part due to an inaccessibility of information. Unless one has access to a quality journal archive and significant motivation, the potentially interested individual is unlikely to encounter the excellent works that exist. A small number of books have been published in the past but these have been primarily aimed at the academic cecidologist. With this New Naturalist volume finally plant galls are explored with an intelligent accessibility. The author is at the top of this field and is well known as co-compiler of the Field Studies Council's Plant Gall identification keys.

First thing: this book is NOT for gall identification (I refer the reader to Redfern and Shirley 2011, FSC publication). This book covers most other topics within cecidology. It is written with a central narrative, with occasional boxes of background information related to the main topic of discussion.

The introduction establishes the basics: what galls are, gall types, variety of inducers and the basis for gall formation. The body of the book is divided into four main parts, each divided into specific chapters.

The first three parts consist of a sequential examination of gall morphological types. These are arranged in terms of their perceived complexity — this takes into account the physical and evolutionary complexity of the gall inducer, the complexity of gall type and the complexity of associated organisms. Establishment of the gall type varieties and the method of inducement in association with the gall inducement organism, all help to illuminate the diversity of these associations. The colour photos within this section are helpful in illustrating the diverse morphological types. The figurative life cycle illustrations of some of the gall-inducing organisms are most helpful. With such complexities as the cyclical parthenogenetic life cycles of cynipid wasps, an illustration or two goes a long way. The diagrams throughout are very helpful, showing such features as cross-sectional interiors of galls, developmental phases and trophic levels of association.

The final part of the book (part four) details other biological aspects of galls and their historical associations with humans.

The interactions and adaptations chapter describes the trophic levels of association. Discussion of the varied gall community associates includes examinations of interactions between the gall/inducer and inquilines, parasitoids, hyper-parasitoids, detritivores and vertebrate/invertebrate attackers. The depth of community associates makes for an illuminating read. As before, Redfern orders the galls in terms of complexity and makes use of associated food webs and instar development drawings.

Examination of gall evolution starts with the limited fossil record and moves onto the causes of evolution. This is done by comparing specific gall types and inducer speciation relating to the gall inducer's choice of plant-inducement site. Redfern uses cladogram representations to illustrate relatedness. Part four also examines the geographic range of gall types. The effect of climate and global distribution of gall inducers related to species types and plant host distribution is elucidated. The effect of human non-native plant introductions on gall diversity is examined — I particularly like the emphasis on *Quercus cerris* introductions and how UK cynipid diversity has increased as a result.

The two non-biological chapters examine human gall usage and the history of human gall understanding. Elucidation of gall use in medicine, tanning, ink making and even as human food (smut fungus on maize, in case you are wondering) make for an interesting change to the biology, with a return to biology in the shape of the modern use of galls as a biological control of weeds. The book closes examining how gall knowledge pioneered by the ancient Greeks remained unsurpassed until the nineteenth century.

Although this book can be considered a fount of information on galls, promotion of future research areas will offer encouragement to ambitious students, as some areas of low understanding are acknowledged (e.g., the understanding of molecular-level phenomena and precise-inducement mechanistic processes).

This is probably not a book that many would pick up and read sequentially from beginning to end, but rather an excellent book of reference that can be used to learn about specific aspects, as and when the interest arises. The blend of diverse topics along with the intelligent but accessible writing style make this an excellent addition to any biologist's library. *Plant galls* is a reference book that will serve the amateur naturalist and cecidologist well for years to come.

TOMMY ROOT

Survey of Bookham Common

SIXTY-NINTH YEAR

Progress Report for 2010

Introduction 211
Vegetation 211
Birds 213
Odonata and other insects Field Study Day, 10 July 2010 214
Additional field notes 215
Moths 216
Contributors' addresses 233

Introduction (Stuart Cole, Chairman, Bookham Common Survey)

The National Trust, under the guidance of the resident warden Ian Swinney, has continued the programme of thinning the mature woodland to create clearings, removing scrub to extend the area of open pasture and also opening the vegetation around some of the ponds. On the banks of Upper Eastern Pond a brushwood barrier has been erected to deter dogs from entering the water and conceal the path so as to encourage the return of nesting birds. In the hope that this succeeds, a viewing hide has been erected for public use.

Following his two successful light-trapping events in 2009, Paul Wheeler, Butterfly Conservation's Moth Officer for Surrey and South-west London, set up his light traps before each survey day from April to October (with the exception of August). Paul's preliminary report on the moths recorded in the traps, as well as other moths he has found at Bookham, principally leaf-mining species, is included in this report.

Tristan Bantock also made nearly monthly visits to Bookham during 2010 and continuing into 2011 to record the Hemiptera, both Heteroptera and Auchenorrhyncha. He expects to write up his records for the next edition of *The London Naturalist*.

Two study days were held during the summer, the first led by Neil Anderson in July for Odonata and other insects and the second led by Sarah Barnes in August for Orthoptera.

Vegetation (Steve Mellor)

After sixty-nine years of dedicated botanical recording, the frequency of appearance or discovery of new native species on Bookham Common must inevitably decline. We found no new native taxa this year except those arising from nomenclature changes. Stace (2010) now considers scaly male-fern *Dryopteris affinis* and Borrer's scaly male-fern *D. borreri* as separate species rather than subspecies; both are well represented across the Common. However, there have been some interesting reappearances of native taxa, largely associated with refurbishment along the chain of ponds in Division N. The removal of overgrowths of trees and scrub, and disposal of mud and organic detritus dredged from ponds left fertile seedbeds to be exploited. Large numbers of very large plants of pale persicaria *Persicaria lapathifolia* must have arisen from a large viable seedbank, and several nodding bur-marigold *Bidens ceruna* were seen about Upper Eastern Pond. Neither was recorded in the last survey and to our knowledge has not been seen on the Common for more than twenty-five years. It was pleasing to find other taxa infrequently seen on the Common that appeared in Division M about dumped mud and on cleared ground. Some of these were: skullcap *Scutellaria galericulata*, trailing St John's-wort *Hypericum humifusum*, trailing tormentil *Potentilla anglica*, eyebright *Euphrasia* agg. and narrow-fruited water-cress *Rorippa microphylla*, though the last is unlikely to survive away from the water.

This year Divisions M and N around the chain of ponds also gave us most of the new alien plants that made a first appearance on the Common in 2010. Figure 1 shows Upper Eastern Pond after it was refurbished by The National Trust to remove extensive stands of bulrush *Typha latifolia* that had filled most of the pond; it was something of a revelation to discover just how large the pond was and also that it had a small island. To the far left is a new hide for our aging ornithologists, to give them something to lean on and to keep them dry. Far centre and right are the parts of Division M that were cleared of scrub and many trees and where mud was dumped, and where the aliens appeared. These were: bread wheat *Triticum aestivum*, yellow bristle-grass *Setaria pumila*, canary-grass *Phalaris canariensis* and common millet *Panicum miliaceum*. Several cockspur *Echinochloa crus-galli* were also found across Divisions M and N, though this taxon had been seen previously around Tunnel car park after major earth movements there. It is suspicious that all these aliens were grasses, suggesting a common source and it seems likely that they were brought in by human intervention as food for fish or wildfowl and dispersed with the mud, or perhaps were washed down the Greendell Stream from outside the Common.

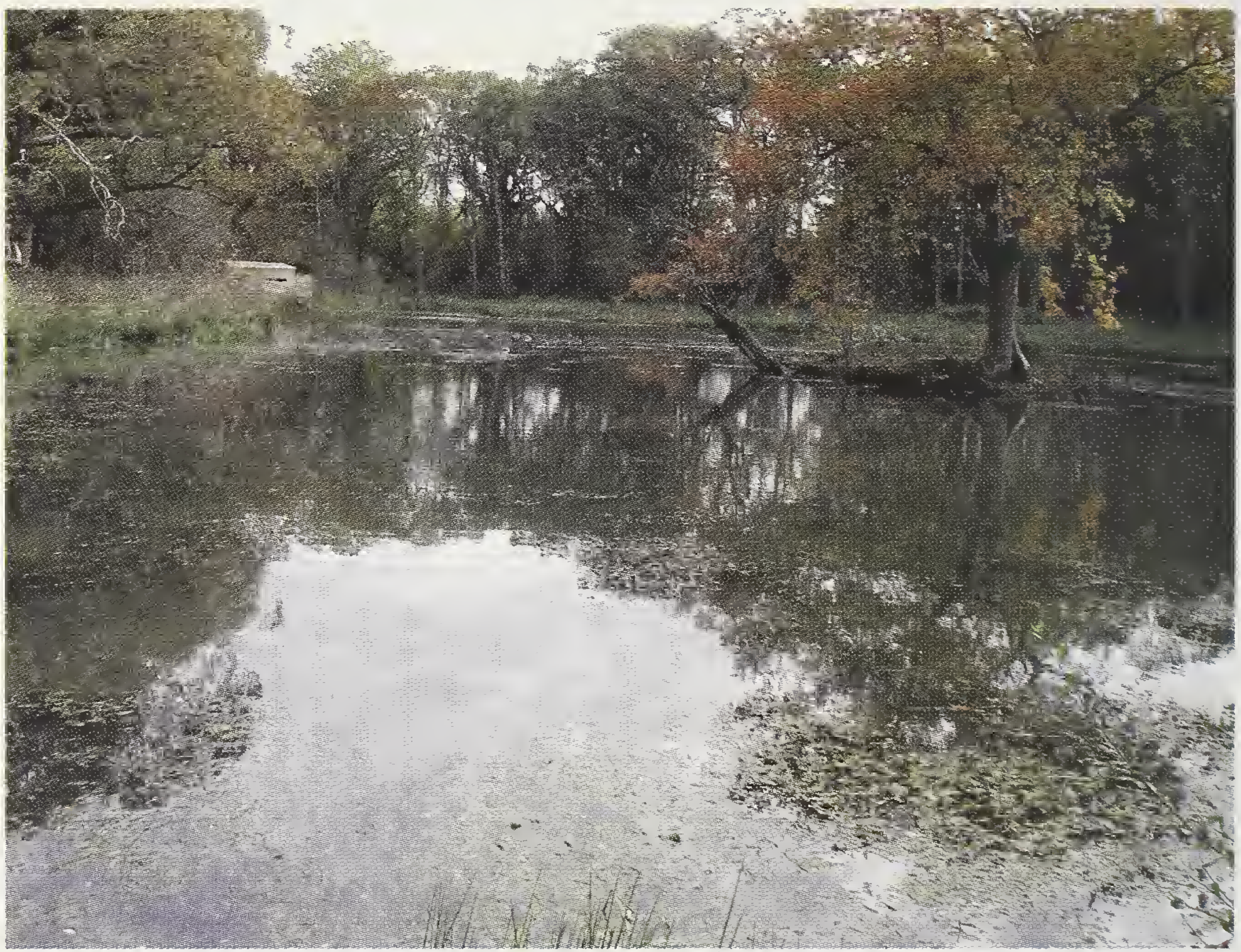


FIGURE 1. Upper Eastern Pond following refurbishment by The National Trust.

Another alien taxon found was a *Primula* variety in Division Q growing with sapling trees on the site of an old bonfire on wood ash covered with charcoal and shown in Figure 2. This plant has clusters of around six primrose-like flowers growing on a stipe; the flowers usually open a rich maroon colour with a yellow eye and fade to a pink. Originally incorrectly named 'garden auricula' when we first found the plant at the end of the flowering season, and later discovered not to be identified in available botanical keys; a specimen was referred to Eric Clement for expert opinion. Eric referred us to Stace (2010) who identifies ours as *Primula* × *pruhonicensis* (*P. vulgaris* × *P. juliae*).

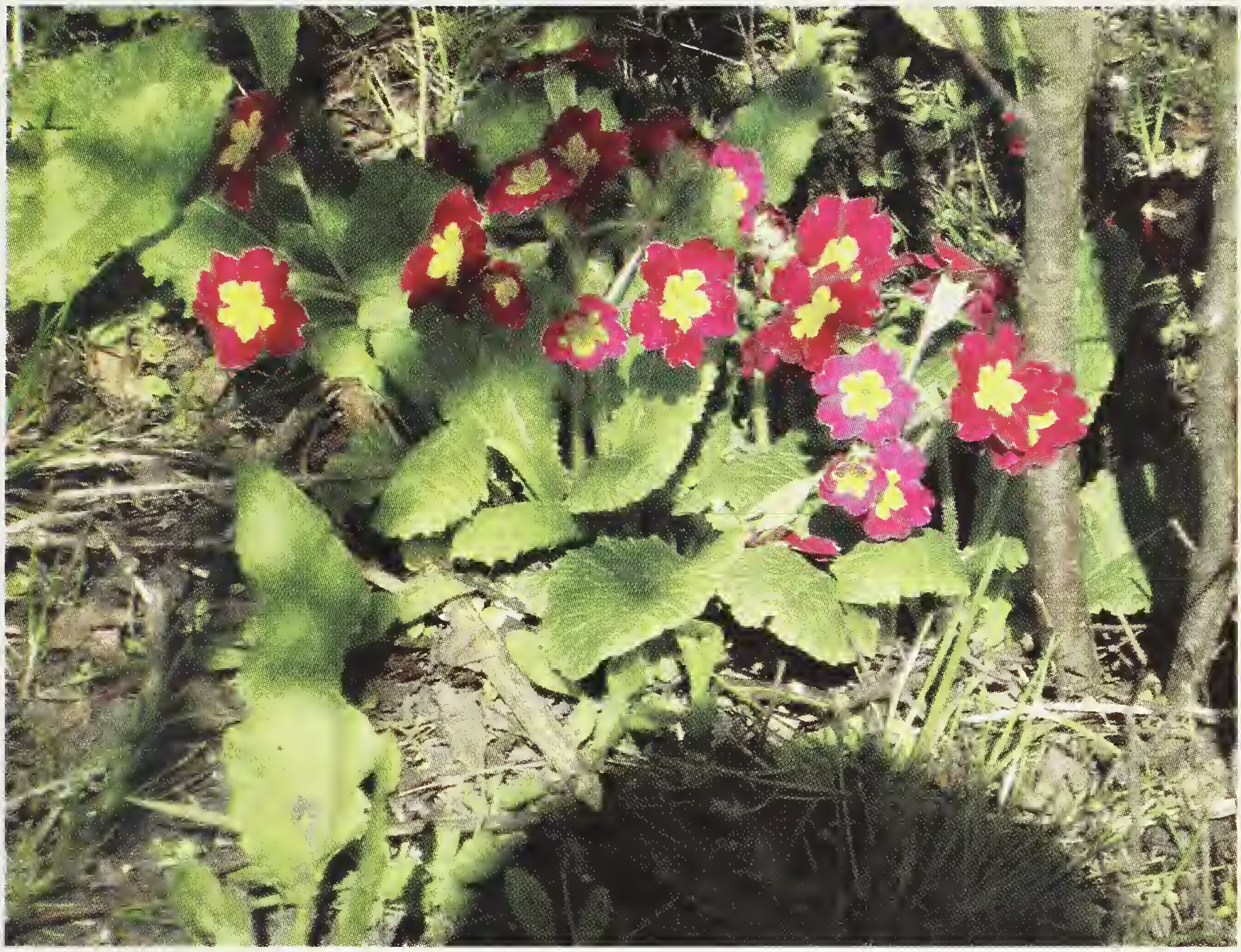


FIGURE 2. *Primula* × *pruhonicensis* growing in Division Q on bonfire ash.

Reference

STACE, C. 2010. *New flora of the British Isles.* Ed. 3. Cambridge University Press, Cambridge.

Birds (Alan D. Prowse)

There were comparatively few visits made to the Common during the year, as I was undertaking a major survey of Ranmore for The National Trust. Records were kept, but no original survey work was done.

The clearing, enlargement, and restoration of the easternmost pond resulted in breeding by a little grebe pair, and a pair of Canada geese nested on the new island there. A pair of tufted ducks was present on the pond system though no young were seen. The opening up of the pond system to more light had beneficial effects on the ecosystem generally. A probable consequence of this was a hobby seen on the Surrey Bird Club meeting on 8 May, though this was eclipsed by three of this species seen in the air together when the London Bird Club visited on 6 June. It would appear that our larger insects, especially Odonata, are the attraction. Previously, the species has been seen only as the occasional migrant, but there seems some hope they may in future breed in the area.

Among other raptors, buzzards are now common in the area over the woods of the Common, and those to the west and north. Sparrowhawks likewise can be seen displaying over the Common and other woods in the area, and are known to breed. This year saw an increase in kestrels, with pairs present over the southern and middle areas of the Common, and a further pair at Chasemore Farm to the north. More red kites were seen passing through Surrey in the first six months of the year than previously, but, of these 146 records, only one was seen at Bookham, on 30 April.

Herons had seventeen successful nests. The heronry is now in the area north of the Isle of Wight Pond in two groups.

A singing reed warbler was found by London Bird Club on 6 June 'nowhere near any reeds'. Three pairs of lesser whitethroats held territory. Willow warblers had only about four territories, though garden warblers, chiffchaffs and whitethroats were well represented on the plains. One male cuckoo persisted for some weeks. After a very poor showing last year, nightingales showed a welcome resurgence. Five males were singing in their territories on 8 May, and this did not include the two known to be in the traditional spot at the northern end, so a total of seven is better than recent years.

A few pairs of swallows still nest at the houses at the western edge of the Common, and a traditional nesting place for house martins is still at a house by the allotments at the western edge. Over the past few years there seems to have been a slight increase in the number of song thrush territories, and the same applies to stock doves. Turtle doves are a distant memory, but collared doves are present at the southern end of the Common, and at the eastern side in the gardens at Commonside.

A decade ago reed buntings still nested, but have now disappeared. Yellowhammers are present along the road past Chasemore Farm to the north between the Common and the M25, usually one pair but occasionally two. There are linnets there too. Linnets have been uncommon breeders on the Common for at least the last fifteen years, but a pair were flying and calling around Bayfield Plain on 21 June, and they can also be found in the allotments area to the west.

Odonata and other insects Field Study Day, 10 July 2010

(Neil Anderson)

Good weather had productive results for this study day. Starting cloudy it soon became hot and sunny, reaching 30°C.

Seventeen species of butterfly were noted including a first record of a marbled white for the site, a species that has been increasing in recent years. The first butterfly of the day was a purple emperor on an oak at the railway station, the first time I'd seen one here. Another two were nearby and after lunch five males were seen at the well-known lek site. Elsewhere a female purple emperor appeared to be investigating sallows for oviposition. Other Bookham specialities were also recorded in good numbers with about ten white admirals and about twenty silver-washed fritillaries. Ringlets were the most abundant brown and a pattern I found at many sites during 2010 was that meadow browns were present in fairly low numbers.

During lunch we examined the contents of the light traps which were run by Paul Wheeler the previous night. Some attractive moths were examined by the group; the species included both poplar and elephant hawkmoths, buff arches, miller, black arches, buff tip and blood-vein.

Following a record dry spring the stream by Bayfield Plain was lacking water, which was disappointing having discovered beautiful demoiselles *Calopteryx virgo* there last year and the species was present in June this year when the stream was still flowing. However, I did find a single female today in a shaded area about 200 metres from the purple emperor lek site. Small numbers of the regular Odonata were recorded on the Isle of Wight Pond with male emperor, brown hawker, ruddy darters, black-tailed skimmers and broad-bodied chasers.

Among the sixty-nine species of Hemiptera identified today by Tristan Bantock were both adult and a nymph of the tortoise bug *Eurygaster testudinaria* and the striking nymph of the carnivorous *Zicrona caerulea*.

Other than invertebrates, a pair of buzzards, a roe deer and a grass snake were recorded.

Additional field notes (Stuart Cole)

12 June. A good variety of beetles were noted, outstanding among which were the tenebrionid *Diaperis boleti* in bracket fungi and three species of jewel beetles of the genus *Agrilus* that were present in one of the clearings in the woodland along Common Road.

Six adults of the black and red *Diaperis boleti* were tapped out of a specimen of the bracket fungus *Piptoperus betuli* on a dead birch trunk along Common Road. This formerly rare insect has spread rapidly through Surrey in recent years and those found today were the first of the species recorded at Bookham.

The *Agrilus* were on log stacks and also swept from the herbaceous vegetation, much of it the alien small-flowered balsam *Impatiens parviflora*, springing up across the open ground of the recently created clearing. The majority of the beetles were the small *Agrilus angustulus*, there were a few *A. viridis* whose larvae feed in stressed sallow trees, and just one of *A. biguttatus*. The latter, at up to 13 mm in length, is the largest of the British buprestids, the larvae feeding in oak wood.

Another insect seen, briefly, by Sarah Barnes, in the clearing was the yellow-legged clearwing moth *Synanthedon vespiformis*.

Although the invasive introduced ladybird *Harmonia axyridis* was recorded for the first time at Bookham Common only in 2009, larvae and adults were already present in abundance everywhere just a year later. Among other Coleoptera found today were *Denticollis linearis* (Elateridae), *Tillus elongatus* (Cleridae), *Pyrochroa serraticornis* and *P. coccinea*, *Gastrophysa polygoni* (Chrysomelidae) and the following cerambycids: *Rhagium mordax*, *Clytus arietis* and *Pachytodes cerambyciformis*.

On the lawn outside the LNHS hut workers of the European bumblebee *Bombus hypnorum* were attending flowers of clover. This is another insect species recently established in the UK that was recorded for the first time at Bookham in 2009 when one specimen was caught in a Malaise trap.

22 June. *Agrilus biguttatus* was more in evidence and several were flying around and landing on the cut ends of the oak logs stacked in the clearing along Common Road and by Merritt's Cottage. They were noticeable in flight from a distance because of the flash of metallic blue on the abdomen exposed beneath the wings. The other *Agrilus* were much fewer, in fact none of *viridis* were found.

As I approached the LNHS hut around midday a pair of grey herons and a common buzzard were circling together high above for many minutes and were then joined by another buzzard with the four birds continuing to circle, spiralling higher into the sky. This is the first time that I have seen herons thermalling.

10 July. The very locally distributed spider, *Hyptiotes paradoxus*, one of only two species of the family Uloboridae occurring in north-west Europe, was found in the vegetation beside the Isle of Wight Pond. It makes a web of unusual construction and is notable for the absence of poison glands.

Bugs swept included pentatomid *Zicrona caerulea*, a metallic blue adult and a nymph with dark red abdomen, and the delphacid *Conomelus anceps*. There were several of the latter, one being of the macropterous form with attractively marked wings and the others the more frequent brachypterous form. Of the sixty-seven other Hemiptera identified by Tristan Bantock today were eight species recorded new for Bookham. Some of these are very common and were doubtless overlooked in the past (e.g., *Javesella pellucida*, *Typhlocyba quercus*); others such as *Iassus scutellaris* and *Stictopleurus punctatonervosus* are relatively recent arrivals in the UK.

11 September. The logs from oak trees cut to create clearings continue to yield a good variety of beetles and other insects. Under the bark on oak logs by Merritt's Cottage were the following small beetles: *Bitoma crenata* and

Pycnomerus ferrugineus (Colydiidae), *Silvanus unidentatus* and *Uleiopa planata* (Silvanidae), *Corticarina minuta* (Latridiidae), *Cerylon fuliginosus* (Cerylonidae), *Paromalus ferrugineum* (Histeridae), *Scydmaenus rufus* (Scydmaenidae) and *Dryocoetes villosus* (Scolytinae). The elongate brown *Pycnomerus* is an introduced species, native to Australia, that is local in Britain but appears to be extending its range. All were present in some numbers along with larvae of the cardinal beetles *Pyrochroa*. Earlier several *Platypus cylindrus* were present on the bark of one log which was covered in fine powdery frass which indicates that *Platypus* is active in the timber. Also under the bark were the black bug *Xylocoris cursitans* (Anthocoridae) which is usually brachypterous as these were, but fully winged individuals can be found. It feeds on other small insects, beetles, Collembola, etc. under bark.

9 October. Paul Wheeler light trapped outside the hut and by the ponds. There was a good selection of autumn moths and many caddis flies of several kinds from the pond trap. Many of the moths were the same as those at light in October, last year, e.g. merveille du jour, green-brindled crescent, chestnut, satellite, barred sallow, pink-barred sallow and willow beauty. Those that were new this time included broad-bordered yellow underwing and common wainscot. Among other insects in the traps were a hornet, the ladybird *Harmonia axyridis* and a weevil of the genus *Sitona*.

On a log outside the cottage the flutter of insect wings attracted my attention to a female of the very large ichneumon-fly *Dolichomitus imperator* as it landed on one of the oak logs. It must have been about 8 to 9 cms in length including the ovipositor which was a bit more than half the total. She searched the log for a few minutes at a time flying off and returning several times over the next three quarters of an hour or so. She attempted oviposition briefly but did not complete as far as I could tell. I assume she was trying to locate longhorn beetle grubs within the log.

Moths (Paul R. Wheeler)

Bookham Common is well recorded for moths and is an excellent site. In all, 276 larger moth species were recorded between 1976 and 1996 (Collins 1997, Plant 1993) in the TQ1256 tetrad in which most of Bookham Common lies. The London atlas (Plant 1993) also adds a further sixteen pre-1980 records. Since 2005, micromoth species have been intensively recorded in Surrey, including Bookham Common, and an atlas is planned for 2012 in the Surrey Wildlife Trust series.

During 2010, trapping with mercury-vapour (mv) lights was carried out on the Thursday or Friday preceding study or survey days in April to October, except August when PRW was not available. At least one trap was always sited within 80 metres of the LNHS hut, and on favourable evenings, further moth traps were set up away from the LNHS hut. In addition, records were made by day and by dusk by tapping branches and observing flying moths; by finding larvae including leaf mines (mostly done in 2005); by attracting to pheromone lures — these are included when reported on study or survey days (Table 1). A record of puss moth from 2002 is included as it is an addition to the records for the Common, and two sets of records from trial mv trapping in 2009, on 12 June and on 8 October, are included in full.

A précis of the records is shown in Table 2. It is planned to include complete records and methods of recording in a manuscript that is being prepared and, in the interim, to post complete records on the Society's website (http://www.lnhs.org.uk/index.htm), as an excel file. This file will include notes on the weather on each moth-trapping night and for each record, a full description of the trap site, grid reference, the 'method', type of trap used, whether recorded as larvae or leaf mines, the date, abundance, notes such as foodplant for larvae, and status.

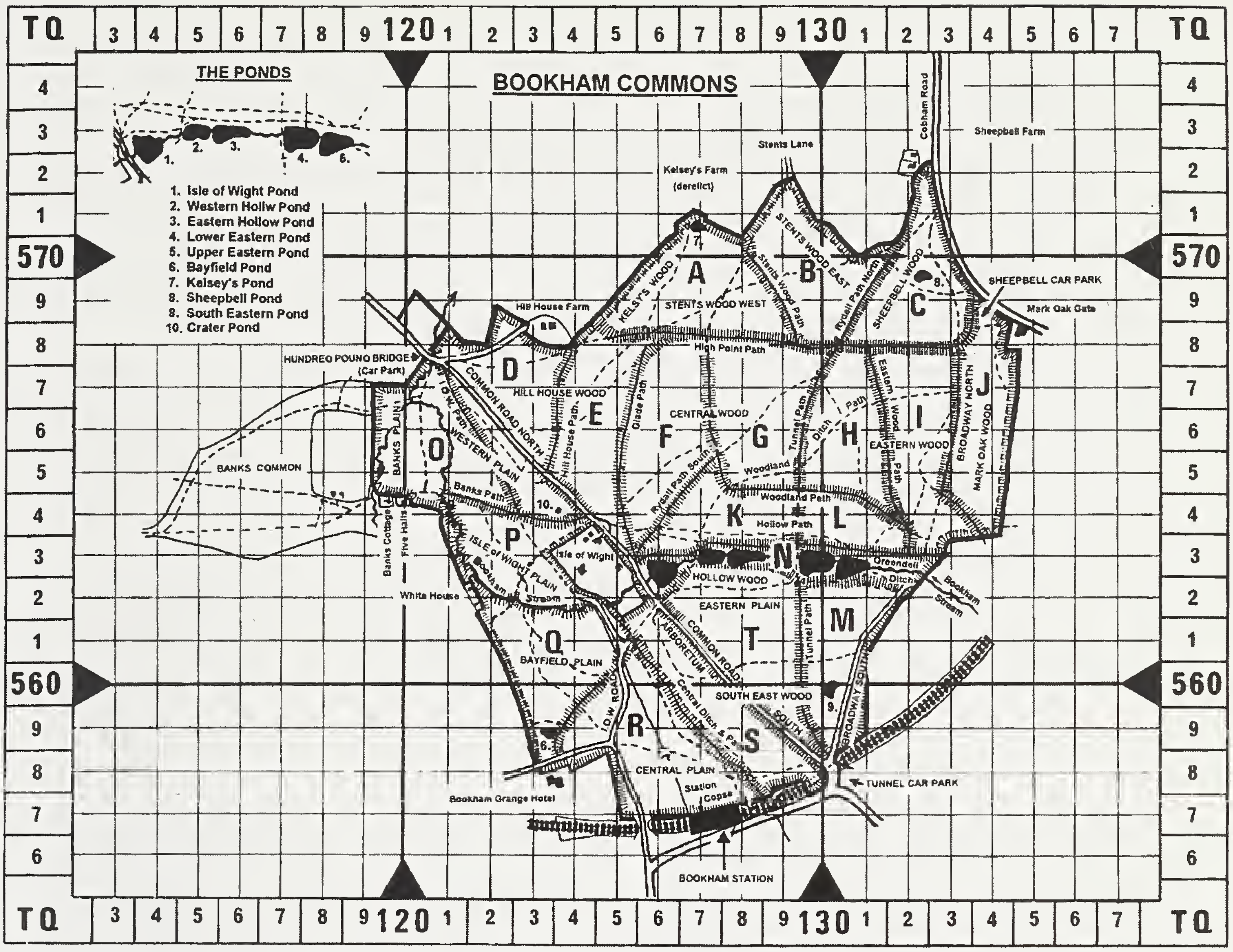


FIGURE 1. Map of Bookham Common showing recording area, paths, roads, woods, plains and ponds.

TABLE 1. The codes below, used in the list of moths in Table 2, enable one line only to be required for each species. Under 'where', consistent with the lettering of the sections in the map (Figure 1). Note: where on the boundary of two sections the first letter alphabetically is used in the code.

Code	Description	Grid ref.
D1	Hill House Wood under purple emperors' 'master oak'	TQ124566
D2	Common Road SE of Hundred Pound Bridge	TQ122565
E1	Glade path south end where it emerges from the wood	TQ124564
K1	Isle of Wight Pond	TQ126561 or TQ126562
K3	Eastern Hollow Pond	TQ128562
K4	Lower Eastern Pond	TQ129562
K5	Upper Eastern Pond	TQ131562
O1	Banks Path by large sallows	TQ122564

TABLE 1. Continued.

O2	Banks Plain right against blackthorn	TQ120565
Q1	Bayfield Plain amongst blackthorn	TQ124560
Q2	Field with white poplars next to Bookham Grange Note this is in tetrad TQ1254	TQ124557
R1	Central Plain amongst blackthorn	TQ124557
T1	Eastern Plain by mature aspen	TQ128560
W1	By Isle of Wight, a junction of rides 50 m from the LNHS hut or just NE of Common Road, 80 m from hut	TQ124563 or TQ125563
W2	The LNHS hut	TQ125563
Under 'method':		
day	Found by day, disturbed or day-flying	
fs	Feeding signs, leaf mines or cases	
le	low energy light, at the porch of the LNHS hut	
mix	David Gardner trap, a combination of tungsten and mv light	
mv	125W mercury-vapour light, Robinson or Skinner design trap	
str	12W fluorescent strip light with Heath trap	

'Months' are shown in numeral form for each month recorded, prefaced with L if recorded as a larva. 'Abundance' is given as accurately as possible but if this was not noted × is written. Where two values are given, these are abundance in 2009 and 2010, separated by a comma. Separate columns for each year cannot be justified as only trial mv-trapping was done, on two occasions, in 2009.

Status, conservation categories and additional records

These national categories are as described in Waring et al. (2009) for larger moths and on the Hampshire moths website (http://www.hantsmoths.org.uk/) for micromoths. Biodiversity Action Plan species are from the list on the Butterfly Conservation website (http://www.butterfly-conservation.org/downloads/390/ biodiversity_action_plan.html). In Table 2, there were no RDB species recorded, but Nationally Notable, Local and Uncommon species were. The Biodiversity Action Plan (BAP) species were all category 4, BAP4 species that are in decline and are to be recorded, but are not a priority for specific conservation measures. If status is not noted in the table, the moth is common or unstated. The unofficial status, Surrey Notable, is noted in the table for nationally common or unstated. Surrey Notable is a term taken from the provisional atlas of micromoths dated April 2010 (J. Porter, pers. comm.), for moths found in ten or fewer tetrads in Surrey.

Some new species of moths were found in the TQ1256 tetrad that covers nearly all of the Common. They are referred to as 'Additional records', abbreviated to 'Add rec' in the table. These are records additional to those for TQ1256 in Plant (1993) and Collins (1997) for larger moths, while the additional microlepidoptera moth records are additions to those in a provisional atlas (J. Porter, pers. comm., April 2010).

TABLE 2. Bookham Common moth records, P. R. Wheeler et al., 2005 to 2010 (plus one additional record from 2002). The numbers in the left column follow the Bradley (2000) checklist.

BF no.	Common name	Scientific name	Where	Method	Months	Abundance	Add rec	Status
6		*Eriocrania subpurpurella*	all TQ1256	day,mv, str	4	>30		
15	Orange swift	*Hepialus sylvina*	T1	str	9	1	Add rec	
17	Common swift	*Hepialus lupulinus*	W1	mv	6	4		
29		*Ectodemia atricolis*	W2	fs	L10	>30	Add rec	
34		*Ectodemia occultella*	Q1	fs	L10	X		
35		*Ectodemia minimella*	Q1	fs	L10	X		
50		*Stigmella aurella*	R1	fs	L10	X		
64		*Stigmella continuella*	Q1	fs	L10	X		
79		*Stigmella perpygmaeella*	Q1	fs	L10	X		
83/84		*Stigmella ruficapitella* agg.	W2, Q1	fs,mv	6,L10	X		
89		*Stigmella basiguttella*	Q1	fs	L10	X		
99		*Stigmella hybnerella*	W2, Q1	fs	L10	~10		
100		*Stigmella oxyacanthella*	W2	fs	L10	2		
111		*Stigmella microtheriella*	K3	fs	L10	X		
113		*Stigmella sakhalinella*	Q1	fs	L10	X		Local
117		*Stigmella confusella*	Q1	fs	L10	X		
123		*Tischeria ekebladella*	Q1, E1	fs,mv	6,L10	X		
129		*Invercurvaria pectinea*	K1	fs	L6	>30		
149		*Adela cuprella*	O1	day	4	~30		Local
157		*Heliozela hammoniella*	W1	mv	6	1		Local
175		*Narycia monilifera*	K1	day	6	1		
286		*Caloptilia alchimiella*	W1	mv	6	1		

288		*Caloptilia stigmatella*	Q1, Q2	fs	L9,L10	~10		
293		*Caloptilia syringella*	R1	fs	L10	X		
301		*Paronix betulae*	Q1	fs	L10	X		
303		*Parornix anglicella*	all IoW area	fs,mv	6,9,L9, L10	~20,~10		
304		*Paronix devoniella*	K3	fs	L10	X		
308		*Parornix finitimella*	R1, W1	mv,mix	4,5	2	Add rec	
323		*Phyllonorycter oxyacanthae*	W2, R1	fs	L10	~20		
329		*Phyllonorycter spinicolella*	W2	fs	L10	~6		
332		*Phyllonorycter corylifoliella*	W2, R1	fs	L9,L10	~6		
341		*Phylonorycter maestingella*	K4, K5	fs	L10	X		
342	Nut leaf blister moth	*Phylonorycter coryli*	K4	fs	L10	X		
345		*Phylonorycter rajeella*	K4	fs	L10	X		
353		*Phylonorycter ulmifoliella*	Q1	fs	L10	X		
358		*Phylonorycter froelichiella*	K4	fs	L10	X		
359		*Phylonorycter nicellii*	K4	fs	L10	X		
360		*Phylonorycter kleemannella*	K4	fs	L10	X		
365		*Phylonorycter comparella*	Q2	fs	L9,L10	B		Notable/Nb
368		*Phyllocnistis unipunctella*	Q2	fs	L9	B		
374	Yellow-legged clearwing	*Synanthedon vespiformis*	D1	Vespi lure	7	1	Add rec	Notable/Nb
379	Red-belted clearwing	*Synanthedon myopaeformis*	W2	myo lure	7	4	Add rec	Notable/Nb
385	Nettle tap	*Anthophila fabriciana*	K1	day	6	1		
410		*Argyresthia brockeella*	W1	mv	7	~4		
411		*Argyresthia goedartella*	W1	mv	7	~6		
417		*Argyresthia spinosella*	W2	day	6	1		

422		*Argyresthia albistria*	W2, W1	day, mv	7,9,10	6		
424	Bird cherry ermine	*Yponomeuta evonymella*	W1	mv	7	2	Add rec	
436		*Pseudoswammerdamia combinella*	O2	str	5	1	Add rec	Uncommon
437		*Swammerdamia caesiella*	Q1	larvae	L10	~10		
440		*Paraswammerdamia albicapitella*	W2	dusk	6	1		
441	was *lutarea*	*Paraswammerdamia nebulella*	W1, K4	mv	7	~12		
449	Ash bud moth	*Prays fraxinella*	W1	mv	6	3		
450	Hawthorn moth	*Scythropia crataegella*	W1	mv	6	4		
459		*Ypsolopha sylvella*	W1, K4	mv	9	2		
460		*Ypsolopha parenthesella*	W1	mv	9	1		
472		*Digitivalva pulicariae*	W1	mv	4,5	2		Local
481		*Epermenia falciformis*	W1	mv	6	3		Surrey notable
490/2		*Coleophora luti/flavipennella* agg.	W1, K4	mv	7	~10		
495		*Coleophora spinella*	W2	fs	L10	1		
518		*Coleophora mayrella*	W1	mv	6	1		
523		*Coleophora hemerobiella*	W2	fs	L6	1		Notable/Nb, increasing
536		*Coleophora betulella*	W1	mv	7	~4	Add rec	
553		*Coleophora striatipennella*	W1	mv	6,7	2,1		
584		*Coleophora alticolella*	W1	mv	6	5		
637		*Crassa tinctella*	E1	mv	6	1		Local
642		*Batia unitella*	W1	mv	7	3		
647	Brown house moth	*Hofmannophila pseudospretella*	W1	mv	6	2		
648	White-shouldered house moth	*Endrosis sarcitrella*	inside W2	indoors	6	1	Add rec	

658		*Carcina quercana*	W1, K4	mv	7,9	6		
663		*Diurnea fagella*	W2, W1	mv	4	6		
688		*Agonopterix heracliana*	T1	str	10	1	Add rec	
697		*Agonopterix aranella*	T1	str	9	1		
701		*Agonopterix ocellana*	W2	le	6	1		
726		*Metzneria metzneriella*	E1	mv	6	1	Add rec	
730		*Apodia bifractella*	W1	day	8	X		
731		*Eulamprotes atrella*	W1	mv	6	4		
774		*Teleiodes luculella*	W1, K4	mv	7	4		
779		*Bryotropha affinis*	W1	mv	7	1	Add rec	
844		*Syncopacna larseniella*	W1	mv	7	5		
866		*Brachmia blandella*	W2	le	7	1		
868		*Helcystogramma rufescens*	K4	mv	7	1		
873	was *lignea*	*Blastobastis adustella*	K4	mv	8	1		
874	was *decolorella*	*Blastobastis lacticolella*	W1	mv	10	4		
937		*Agapeta hamana*	W2, W1	mv, le	6,7	2		
945		*Aethes cniciana*	E1	mv	6	2		
969	Chequered fruit-tree tortrix	*Pandemis corylana*	W1, T1	mv, str	7,9	10		
970	Barred fruit tree tortrix	*Pandemis cerasana*	W1, T1, E1	mv	6,7	1,7		
977	Large fruit-tree tortrix	*Archips podana*	W1	mv	6,7	2,1		
980	Variegated fruit-tree tortrix	*Archips xylosteana*	W1	mv	6,7	21,3		
983		*Choristoneura hebenstreitella*	W1, E1	mv	6	3,5		
989	Timothy tortrix	*Aphelia paleana*	W1	mv	6	1		
1000		*Ptycholoma lecheana*	E1	mv	6	2		

1006		*Epagoge grotiana*	K4	mv	7	1		
1010	Red barred tortrix	*Ditula angustiorana*	W1, K4	mv	6	1		
1020	Grey tortrix	*Cnephasia stephensiana*	W1	mv	6	1		
1021	Flax tortrix	*Cnephasia asseclana*	K4	mv	7	1		
1032		*Aleimma loeflingiana*	W1	mv	6	2		
1033	Green oak tortrix	*Tortrix viridana*	all TQ1256	mv, str, le	6,7	95,16		
1036		*Acleris forsskaleana*	W1	mv	7	1		
1037		*Acleris holmiana*	W1	mv	7	1		
1042	Rhomboid fruit tortrix	*Acleris rhombana*	all TQ1256	mv, str, le	9,10	5,5		
1062		*Acleris emargana*	W1, T1	mv, str	9,10	6		
1063		*Celypha striana*	W1, W2	mv	6,7	1,1		
1076		*Celypha lacunana*	all TQ1256	mv, str	6,7,9	40,13		
1082	Plum tortrix	*Hedya pruniana*	W1, E1	mv	6	5,4		
1083	Marbled orchard tortrix	*Hedya nubiferana*	W1, K1	mv	6	5		
1086		*Hedya salicella*	W1	mv	7	1		
1088		*Pseudosciaphila branderiana*	T1	mv	6	3	Add rec	Uncommon
1092		*Apotomis turbidiana*	T1	mv	6	5	Add rec	
1093		*Apotomis betuletana*	W1, T1	mv, str	6,7,9	2,8		
1111		*Bactra lancealana*	W1	mv	6	3		
1115		*Ancylis achatana*	W1	mv	7	4		
1119a		*Ancylis diminutana*	W1	mv	7	1	Add rec	Local
1123		*Ancylis laetana*	T1, E1	mv	6	4	Add rec	
1126		*Ancylis badiana*	W1	mv	7	1		
1133		*Epinotia bilunana*	W1, T1	mv	6	1,2		

1135		*Epinotia demarniana*	T1	mv	6	1	Add rec	Notable/Nb, increasing
1138		*Epinotia nisella*	W1	mv	9	2		
1165		*Zeiraphera isertana*	W1	mv	7	6		
1169		*Gypsonoma dealbana*	W1, K4	mv	7	~5		
1175	Bramble shoot moth	*Epiblema uddmanniana*	W1, E1	mv	6,7	5,2		
1176		*Epiblema trimaculana*	W1, K1, E1	mv, str	6	4,1		
1177		*Epiblema rosaecolana*	W1, K1	mv, str	6,7	1,1		
1201		*Eucosma cana*	W1	mv	7	1		
1205	Bud moth	*Spilonota ocellana*	W1, K4	mv	9	2		
1261	Codling moth	*Cydia pomonella*	W1	mv	9	1	Add rec	
1288	Many-plume moth	*Alucita hexadactyla*	Cen Pl, T1	mix, str	4,9	4		
1292		*Calamotropha paludella*	W2	le	7	1	Add rec	Notable/Nb, increasing
1293		*Chrysoteuchia culmella*	W1	mv	6,7	~40		
1309		*Agriphila geniculea*	K4, T1	mv, str	9	5		
1334		*Scorparia ambigualis*	all TQ1256	mv, str	6,7	5,29		
1336		*Eudonia pallida*	W1	mv	9,10	5	Add rec	
1338		*Dipleurina lacustrata*	W1	mv	7	4		
1376	Small magpie	*Eurrhypara hortulata*	W1, W2, K4	mv, le	6,7	3,~12		
1385		*Ebulea crocealis*	W1	mv	7	1		
1392		*Udea olivalis*	W1, W2	mv, le	6,7	1,2		
1405	Mother of pearl	*Pleuroptya ruralis*	W1	mv	7	~6		
1413	Gold triangle	*Hypsopygia costalis*	W1, K1	mv	9,10	2		
1428	Bee moth	*Aphomia sociella*	W2	le	6	1		
1433		*Cryptoblabes bistriga*	T1	str	9	2		Local

1436		*Conobathra repandana*	W1	mv	7	1		
1437		*Acrobasis consociella*	W1	mv	7	1		
1452		*Phycita roborella*	W1, K4, T1	mv	7,9	10		
1513	White plume moth	*Pterophorus pentadactyla*	W2	le	7	1		
1524		*Emmelina monodactyla*	R1, W2	mix, le	4,7	2		
1642	The lappet	*Gastropacha quercifolia*	W2	mv	7	1	Add?(pre-1976 rec)	Scarce
1646	Oak hook tip	*Drepana binaria*	W1, K4	mv	9	~10		BAP4
1648	Pebble hook tip	*Drepena falcataria*	W1, T1, E1	mv	4,6	4		
1652	Peach blossom	*Thyatira batis*	W1, T1	mv	6,7	~6		
1653	Buff arches	*Habrosyne pyritoides*	W1	mv	6,7	2,~10		
1658	Oak lutestring	*Cymatophorima diluta*	W1, K4, T1	mv, str	9	31		BAP4
1660	Frosted green	*Polyploca ridens*	W1, W2	mv	4,5	9		Local
1662	Light orange underwing	*Archiearis notha*	D2	day	4	1	Add?(pre-1976 rec)	Notable/Nb
1667	Blotched emerald	*Comibaena bajularia*	W1	mv	6	14		Local
1669	Common emerald	*Hemithea aestivaria*	W1	mv	7	2		
1680	Maiden's blush	*Cyclophora punctaria*	W1	mv	5,9	3		Local
1682	Blood vein	*Timandra griseata*	W1	mv	6,7	1,1		
1690	Small blood vein	*Scopula imitaria*	W2	le	7	1	Add rec	
1711	Treble brown spot	*Idaea trigeminata*	W1	mv	7	2		
1713	Riband wave	*Idaea aversata*	W1	mv	7	5		
1722	Flame carpet	*Xanthorhoe designata*	W1, T1	mv	6	1,1	Add rec	
1724	Red twin-spot carpet	*Xanthorhoe spadicerea*	W1, W2, R1, O2	mv, str, le	4,5	5		
1727	Silver ground carpet	*Xanthorhoe montanata*	all TQ1256	mv, str, le	6	3,3		

1738	Common carpet	*Epirrhoe alternata*	W1, T1	mv	6	1,1		
1742	Yellow shell	*Camptogramma bilineata*	W1	mv	9	1	Add rec	
1746	Shoulder stripe	*Anticlea badiata*	W2, R1	mv, mix	4	6		
1747	Streamer	*Anticlea derivata*	W2,Q1, R1	mv, mix, str	4	~8		
1750	Water carpet	*Lampropteryx suffumata*	W2,Q1, R1	dusk	4,5	5		
1752	Purple bar	*Cosmorhoe ocellata*	W1	fs		1		
1760	Red-green carpet	*Chloroclysta siterata*	W1	mv	10	1,2	Add rec	
1764	Common marbled carpet	*Chloroclysta truncata*	W1, K1	mv	6,10	1,1		
1768	Grey pine carpet	*Thera obeliscata*	W1	mv	9	1		
1773	Broken-barred carpet	*Electrophaes corylata*	W1	mv	4,6	1,1		
1776	Green carpet	*Colostygia pectinataria*	all TQ1256	mv, str, le	6,9	6,9		
1777	July highflyer	*Hydriomena furcata*	W1	mv	7	3		
1789	Scallop shell	*Rheumaptera undulata*	W1	mv	7	1	Add rec	Local
1794	Sharp-angled carpet	*Euphyia unangulata*	W1	mv	6	1		Local
1819	Mottled pug	*Eupithecia exiguata*	W1, T1	mv	5,6	3		
1852	Brindled pug	*Eupithecia abbreviata*	all TQ1256, O2	mv, mix, str	4,5	22		
1853	Oak-tree pug	*Eupithecia dodoneata*	W2	mv	5	1		
1860	Green pug	*Chloroclystis rectangulata*	W1	mv	7	2		
1862	Double-striped pug	*Gymnoscelis rufifasciata*	W1, O2	mv, str	5,6	3,,3		
1876	Small yellow wave	*Hydrelia flammeolaria*	W1	mv	7	1		
1879	Seraphim	*Lobophora halterata*	W1, W2	mv	5,6	1,1		
1881	Early tooth-striped	*Trichopteryx carpinata*	W2	mv	4	1		
1882	Small seraphim	*Pterapherapteryx sexalata*	W1, T1	mv	6,7	2		
1887	Clouded border	*Lomaspilis marginata*	W1, T1, E1	mv	6,7	11		

1888	Scorched carpet	*Ligdia adustata*	W1, R1, O2	dusk, mv, mix	4,5,7	5		
1889	Peacock	*Semiothisa notata*	T1, E1	mv	6	4		
1902	Brown silver line	*Petrophora chlorosata*	T1, E1	mv	6	26		
1904	Scorched wing	*Plagodis dolabraria*	W1, T1, E1	mv	6	17		
1906	Brimstone	*Opisthograptis luteolata*	W1, W2, R1, O2	all light	4,5,6,7	4,11		
1907	Bordered beauty	*Epione repandaria*	W1	mv	7	1	Add rec	
1915	September thorn	*Ennomos erosaria*	W1	mv	7	>10		BAP4
1917	Early thorn	*Selenia dentaria*	W1,O1, R1	dusk, mv, mix	4,7	7		
1919	Purple thorn	*Selenia tetralunaria*	W1, K4	mv	4,7	2		
1921	Scalloped oak	*Crocallis elinguaria*	W1	mv	7	1		
1922	Swallow-tailed	*Ourapteryx sambucaria*	W1	mv	7	2		
1923	Feathered thorn	*Colotis pennaria*	W1, K1	mv	10	1,3		
1930	Oak beauty	*Biston strataria*	W2	mv	4	5		
1931	Peppered moth	*Biston betularia*	E1	mv	6	1		
1936	Waved umber	*Menophora abruptaria*	W2	mv	5	1		
1937	Willow beauty	*Peribatodes rhomboidaria*	all TQ1256	mv, le	6,7,10	1,9		
1941	Mottled beauty	*Alcis repandata*	W1, K1	mv, str	6,7	11,3		
1943	Great oak beauty	*Hypomecis roboraria*	W1, E1	mv	6	2,1		Notable/Nb
1944	Pale oak beauty	*Serraca punctinalis*	all TQ1256	mv	6	4,11		
1947	Engrailed	*Ectropis bistortata*	W1	mv	4	1		
1948	Small engrailed	*Ectropis crepuscularia*	W1	mv	6	1	Add rec	Local
1951	Grey birch	*Aethalura punctulata*	Q1	dusk, str	4	X		
1955	Common white wave	*Cabera pusaria*	W1	mv	7	3		

1956	Common wave	*Cabera exanthemata*	W1, R1	mv	4,5,7	8		
1957	White pinion-spotted	*Lomographa bimaculata*	W1	mv	6	1		
1958	Clouded silver	*Lomographa temerata*	W1, K1, E1	mv, str	6,7	5,3		
1961	Light emerald	*Campaea margaritata*	all TQ1256	mv, str, le	6,9	8,11		
1981	Poplar hawk	*Laothoe populi*	W1	mv	7	3		
1991	Elephant hawk	*Deilephila elpenor*	W1, E1	mv	6,7	13		
1994	Buff tip	*Phalera bucephala*	W1	mv	7	1		
1995	Puss moth	*Cerura vinula*	W1	larvae	7 (2002)	3	Add rec	
1999	Lobster	*Stauropus fagi*	W1, T1, E1	mv	6	6,5		
2000	Iron prominent	*Notodonta dromedarius*	W1	mv	6,7	2,1		
2003	Pebble prominent	*Eligmodonta ziczac*	Q1	mv,str	4,7	3,1		
2005	Great prominent	*Peridea anceps*	W1, W2, R1	mv	4,5	9		Local
2006	Lesser swallow prominent	*Pheosia gnoma*	W1, R1	mv, mix	4,5	2		
2007	Swallow prominent	*Pheosia tremula*	W1	mv	6,7	1,1		
2008	Coxcomb prominent	*Ptilodon capucina*	T1	mv	6	2		
2011	Pale prominent	*Pterostoma palpina*	T1, E1	mv	6	3		
2014	Marbled brown	*Drymonia dodonaea*	W1, T1, E1	mv	6	4,7		
2015	Lunar marbled brown	*Drymonia ruficornis*	W2, Q1	mv, str	4,5	2		
2019	Chocolate tip	*Clostera curtula*	W1	mv	5	1		Local
2020	Figure of eight	*Diloba caeruleocephala*	W1, K1	mv	10	16,25		BAP4
2028	Pale tussock	*Calliteara pudibunda*	T1, E1	mv	6	6		
2030	Yellow tail	*Euproctis similis*	W1	mv	6	6		
2033	Black arches	*Lymantria monacha*	W1	mv	7	7		Local, increasing
2037	Rosy footman	*Miltochrista miniata*	W1	mv	7	8		Local

2040	Four-dotted footman	*Cybosia mesomella*	W1	mv	6	1		Local
2043	Orange footman	*Eilema sororcula*	W1, T1, E1	mv	6	5,26	Add(pre-1976 rec)	Notable/Nb, increasing
2044	Dingy footman	*Eilema griseola*	W1	mv	7	~4	Add rec	
2047	Scarce footman	*Eilema complana*	W1	mv	7	~3		
2050	Common footman	*Eilema luredeola*	W1	mv	7	~3		
2060	White ermine	*Spilosoma lubricipeda*	all TQ1256	mv	6	7,3		BAP4
2061	Buff ermine	*Spilosoma lutea*	all TQ1256	mv	6	5,24		BAP4
2069	Cinnabar	*Tyria jacobaeae*	W1	mv	7	3		BAP4
2077	Short cloaked	*Nola cucullatella*	W1	mv	7	2		
2089	Heart and dart	*Agrotis exclamationis*	W1, T1, E1	mv	6,7	20,20		
2092	Shuttle-shaped dart	*Agrotis puta*	W1	mv	9	1		
2098	Flame	*Axylia putris*	W1, E1	mv	6,7	3		
2102	Flame shoulder	*Ochropleura plecta*	W1, W2, E1	mv	5,6,7	6,5		
2107	Large yellow underwing	*Noctua pronuba*	all TQ1256	mv	6,9,10	10,22		
2109	Lesser yellow underwing	*Noctua comes*	W1, K4	mv	7,9	4		
2110	Broad-bordered underwing	*Noctua fimbriata*	W1, K1, K4	mv	9,10	7		
2111	Lesser broad-bordered yellow underwing	*Noctua janthe*	W1, K4	mv	9	6		
2117	Autumnal rustic	*Paradiarsia glareosa*	W1	mv	9	1	Add rec	BAP4
2120	Ingrailed clay	*Diarsia mendica*	W1	mv	6	1		
2123	Small square spot	*Diarsia rubi*	W1, T1	mv, str	6,9	1,1		BAP4
2126	Setaceous Hebrew character	*Xestia c-nigrum*	W1, K4, T1	mv	6,9	2,5		
2128	Double square spot	*Xestia triangulum*	W1	mv	7	3		
2134	Square-spot rustic	*Xestia xanthographa*	W1, W2	mv	9,10	2,17		

2139	Red chestnut	*Cerastris rubicosa*	W1, W2, R1	mv, mix	4	4		
2145	The nutmeg	*Discestra trifolii*	E1	mv	6	1		
2150	Grey arches	*Polia nebulosa*	T1	mv	6	2		
2154	Cabbage	*Mamestra brassicae*	W1	mv	6	1	Add rec	
2178	Feathered gothic	*Tholera decimalis*	W1, T1	mv, str	9	4	Add rec	BAP4
2182	Small quaker	*Orthosia cruda*	W1, W2	mv	4	93		
2187	Common quaker	*Orthosia cerasi*	W1, W2, R1	mv	4,5	69		
2188	Clouded drab	*Orthosia incerta*	W1, W2, R1	mv	4,5	14		
2189	Twin-spotted quaker	*Orthosia munda*	W2	mv	4	1		
2190	Hebrew character	*Orthosia gothica*	W1, W2, Q1, O2	dusk, mv, str	4,5	2,7		
2193	Clay	*Mythimna ferrago*	W1	mv	7	2		
2198	Smoky wainscot	*Mythimna impura*	K4	mv	9	1		
2199	Common wainscot	*Mythimna pallens*	W1	mv	7,10	4		
2225	Minor shoulder-knot	*Brachylomia viminalis*	W1	mv	6,7	1,10		BAP4
2240	Blair's shoulder-knot	*Lithopane leautieri*	W1	mv	10	2		
2243	Early grey	*Xylocampa aerola*	W1	mv	4	4		
2245	Green-brindled crescent	*Allophyes oxyacanthae*	W1, larva near W2	mv, larva	10,L5	3,4		BAP4
2247	Merveille du jour	*Dichonia aprilina*	W1, K1	mv	10	6,7		
2248	Brindled green	*Dryobotodes eremita*	W1	mv	10	1,3		
2256	Satellite	*Eupsilia transvera*	W1	mv	4,10	11,2		
2258	Chestnut	*Conistra vaccinii*	W1, K1, W2	mv	4,10	5,8		
2262	Brick	*Agrochola circellaris*	W1	mv	10	1		
2263	Red-line quaker	*Agrochola lota*	W1	mv	10	1	Add rec	
2269	Centre-barred sallow	*Atethmia centrago*	W1	mv	10	2		BAP4

2270	Lunar underwing	*Omphaloscelis lunosa*	W1	mv	10	2	Add rec	
2272	Barred sallow	*Xanthia aurago*	W1	mv	10	9,10	Add rec	
2273	Pink-barred sallow	*Xanthia togata*	W1	mv	10	2,2		
2274	Sallow	*Xanthia icteritia*	W1	mv	10	3,4		BAP4
2278	Poplar grey	*Acronicta megacephala*	W1, T1	mv	6,7	2		
2279	Sycamore	*Acronicta aceris*	W1, T1	mv	6	1,1	Add rec	
2280	Miller	*Acronicta leporina*	W1	mv	7	1		
2284	Grey dagger	*Acronicta psi*	W1	mv	7	1		
2289	Knot grass	*Acronicta rumicis*	W1	mv	7	1		
2297	Copper underwing	*Amphipyra pyramidea*	W1, K4, larva near W2	mv, larva	9,10,L5	1,5		
2305	Small angle shades	*Euplexia lucipara*	W1	mv	6	1		
2306	Angle shades	*Phlogophora meticulosa*	W1	mv	6	1		
2311	Double kidney	*Ipimorpha retusa*	W1	mv	7	1		Local
2316	Lesser-spotted pinion	*Cosmia affinis*	W1	mv	7	3	Add rec	Local
2318	Dun bar	*Cosmia trapezina*	W1	mv	7	8		
2321	Dark arches	*Apamea monoglypha*	W1	mv	7	2		
2330	Dusky brocade	*Apamea remissa*	W1	mv	6	1		BAP4
2337/9	Marbled minor aggregate	*Oligia strigilis/latruncula*	W1	mv	6,7	2,8		
2340	Middle-barred minor	*Oligia fasciunculata*	W1, E1	mv	6	2,1		
2341	Cloaked minor	*Mesoligia furuncula*	W1	mv	7	2		
2343/a	Common rustic aggregate	*Mesapamea* spp.	W1	mv	7	2		
2345	Small dotted buff	*Photedes minima*	W1, E1	mv	6	1,1		
2353	Flounced rustic	*Luperina testacea*	K4	mv	9	1	Add rec	

2361	Rosy rustic	*Hydraecia micacea*	W1	mv	10	1		BAP4
2380	Treble lines	*Charanyca trigrammica*	W1, E1, T1	mv	6	2,6		
2381	Uncertain	*Hoplodrina alsines*	W1. K4	mv	7	~10		
2382	Rustic	*Hoplodrina blanda*	W1. K4	mv	7	~4		BAP4
2384	Vine's rustic	*Hoplodrina ambigua*	W1	mv	6,9	1,1	Add rec	
2410	Marbled white spot	*Protodeltote pygarga*	W1, E1, T1	mv	6	4,20		
2422	Green silver lines	*Pseudoips prasinana*	E1, T1	mv	6	3		
2423	Oak nycteoline	*Nycteola revayana*	W2	le	10	1		Local
2425	Nut tree tussock	*Colocasia coryli*	R1, E1	mv, mix	4,6	4		
2442	Beautiful golden Y	*Autographa pulchrina*	W1	mv	7	1		
2450	Spectacle	*Abrostola tripartita*	T1	mv	6	1		
2473	Beautiful hook-tip	*Laspeyria flexula*	W1, T1	mv	6,7,9	6,~6		
2474	Straw dot	*Rivula sericealis*	W1, E1	mv	6,10	25,10		
2477	Snout	*Hypena proboscidalis*	W1	mv	6,7,9,10	3,5		
2489	Fan-foot	*Herminia tarsipennalis*	W1	mv	7	1		

Summary

In all, 321 moth species were recorded, 177 were macrolepidoptera and 144 were microlepidoptera (Table 2). Nearly all the macrolepidoptera were recorded at light, 172 against five only by day including two Sesiidae (clearwings) that came to pheromone lures. Of the microlepidoptera, thirty-six species were recorded only as larvae or leaf mines while seven were recorded only by day, including a white-shouldered house-moth *Endrosis sarcitrella* inside the hut. Nineteen microlepidoptera were additional records for the Common (TQ1256 tetrad) and twenty-two macrolepidoptera records were added. Three other records of the larger moths were previously recorded before 1976; one, the lappet, was recorded in 2005 and featured in *The London Naturalist* (Menzies 2006) and the Society's *Newsletter,* but this may have been from the TQ1254 tetrad.

There were many highlights. Although declining nationally, oak lutestring and figure of eight moth were remarkably abundant. The latter is a blackthorn-dependent species; others noted were green brindled crescent and *Pseudoswammerdamia combinella.* Sloe carpet *Aleucis distinctata*, a rare and elusive blackthorn specialist, was not found, but the recording done only provides a sample of the moths present and does not prove any negatives. Oak specialists were well-represented, including the yellow-legged clearwing, oak lutestring, great oak beauty, great prominent and merveille du jour. Aspen was targetted by placing a trap amongst mature trees and suckers and the most interesting moth found was a tortricid, *Pseudosciaphila branderiana*, never found on the Common before (LeGros 1977). Light orange underwing was also seen by day and the record passed on to me. The moth catches generated great interest on the Survey and Study Days.

Stuart Cole, Tristan Bantock and Mick Massie are all thanked for their encouragement to do the trapping and Ian Swinney for agreeing to let me trap, sometimes overnight, from the LNHS hut.

All the moths listed were determined by PRW except: *Apodia bifractella* and a larva of green-brindled crescent *Allophyes oxyacanthae* by Tristan Bantock; light orange underwing *Archiearis notha* by John Kinsey, confirmed by Martin Honey and others. PRW determined *Argyresthia spinosella* and *A. albistria* that were tapped from blackthorn by Tristan Bantock; the nutmeg *Discestra trifolii* was jointly determined by PRW and Tristan Bantock. David Gardner trapped and determined several moths that were all recorded and determined elsewhere by PRW.

References

BRADLEY, J. D. 2000. *Checklist of Lepidoptera recorded from the British Isles.* Ed. 2, revised. Privately published.

COLLINS, G. A. 1997. *Larger moths of Surrey.* Surrey Wildlife Trust.

LE GROS, A. E. 1977. A working list of the Microlepidoptera of Bookham Common. *Lond. Nat.* **56**: 77–81.

MENZIES, I. S. 2006. Butterflies and moths: field notes for 2005. *In* Survey of Bookham Common, 2005. *Lond. Nat.* **85**: 187–189.

PLANT, C. W. 1993. *Larger moths of the London Area.* London Natural History Society.

WARING, P., TOWNSEND, M. and LEWINGTON, R. 2009. *Field guide to the moths of Great Britain and Ireland.* Ed. 2. British Wildlife Publishing.

Contributors' addresses

Neil Anderson, 52 Beechwood Avenue, Greenford, Middlesex UB6 9VB.
Stuart Cole, 21 Wensleydale Gardens, Hampton, Middlesex TW12 2LU.
Steve Mellor, 22 Pine Dean, Great Bookham, Surrey KT23 4BT.
Alan D. Prowse, 46 Badingham Drive, Leatherhead, Surrey KT22 9HA.
Paul R. Wheeler, 31 Medhurst Close, Chobham, Surrey GU24 8PA.

Book review

Weeds: how vagabond plants gatecrashed civilisation and changed the way we think about nature. Richard Mabey. Profile Books. 2010. Hardback, xii, 324 pp. £15.99. ISBN 978 1 84668 076 2.

The dust wrapper blurb describes this book as a cultural history of weeds. This is not Mabey's first work touching on weeds (which include *Unofficial countryside* and *Street flowers*) but it is his fullest. It is a volume full of fascinating facts and opinions, a veritable potpourri packed with weedy history and folklore. His idiosyncratic style is eminently readable though rambling at times like some of the subjects of the book. He treats of weeds in history and archaeology, weeds in art and literature, weeds in religion, weeds as friends and weeds as foes, and he explores a variety of ways of defining weeds.

A chapter with the title Self-heal hardly needs its sub-title 'the medicinal weed', you know what's coming; arguably you could say the same about Triffid 'the weed at the end of the world'. Other chapter titles are less transparent. Grelda (Mabey's partner's name for ground-elder), 'the witch in the border' is about garden weeds. Gallant-soldier 'the weed as mercenary' is not about weeds and war; it is about plants (e.g., *Galinsoga* and Oxford ragwort) escaping from botanic gardens or moved about by other human activity.

Mabey shows that our attitude to weeds is not consistent: the plants that farmers curse in one century may be listed for their conservation importance in another. Fine new garden plants can become invasive weeds: Mabey reminds us that William Robinson popularized Japanese knotweed, white comfrey was one of his favourites and he thought goat's-rue 'a tall and graceful perennial'.

The book contains some very quotable quotes of which here are a few. 'Weeds can be plants finding themselves in the wrong moment as well as the wrong place.' Successful weeds are 'mobile, prolific, genetically diverse'. 'A tendency to weediness in a plant is as much a matter of opportunity as a fixed character trait.' Weeds can be 'archaeological artefacts, embodying history as if they were arrowheads or old letters, charting our habits and beliefs', but, he adds, that unlike museum specimens they 'are wonderfully and mischievously alive.' The dormancy of poppies Mabey describes as 'legendary' and 'engraved in our cultural memory at Flanders Field'. 'Europe's earth is full of poppies and bleeds when it's cut.'

London gets several mentions: John Gerard's observations in the late 1500s, the effects of the Great Fire and the Blitz, BSBI 'Alien Hunts' in the London area (in the 1970s?) and the impact of the Olympic Park development. For his treatment of the wild plants of the City bomb sites the author draws mainly from Sir Edward Salisbury's work in the 1940s rather than the later, fuller findings of Ted Lousley, A.W. Jones and other LNHS members into the 1950s.

Not all the examples used to support his arguments are from Britain. He reminds us that 'Almost any alien plant seems capable of becoming a weed in Australia'. In the USA, Australian paperbark trees introduced to the Everglades to dry them out sufficiently 'to grow crops and condominiums' subsequently occupied 1,000 square miles of southern Florida, at a density in places of nearly eight million trees per square mile while the remaining open water of the Everglades was being choked by water hyacinth. Then there is kudzu and all those agricultural weeds brought by European colonists.

The book includes too many small mistakes that should have been picked up (weeded out perhaps) by a knowledgeable proofreader: words repeated and sometimes stray words left from an earlier version of the text, Roy Vickery called Ray, the River Tees running through Sheffield, a Biblical quotation said to be from St Peter's Gospel.

These quibbles excepted I thoroughly recommend this book for its wide-ranging reflections on those plants wild or cultivated that at some point in human history have been labelled as weeds. In a short review it is hard to do justice to the breadth of coverage of this fascinating and at times provocative book. You had better read it for yourself.

JOHN SWINDELLS

Botany report for 2010

MARK A. SPENCER

72 Michael Cliffe House, Skinner Street, London EC1R 0WX

Abstract

This report details interesting or significant vascular plant records from within the LNHS recording area polygon for 2010.

Introduction

In my Botany report for the years 2008 and 2009 I mentioned that, for the purposes of this report and for recording (including the London Flora Project), I would be taking up the taxonomic arrangement of Clive Stace's third edition of his *New Flora of the British Isles* (Stace 2010*a*). The arrangement of the *Flora* contains some significant departures from what London botanists have become used to over the last few decades. I won't labour the point by going into detail about the rationale for these changes but will, once more, recommend interested LNHS members to read his article in *Watsonia* (Stace 2010*b*) for further information. For those of you who would like a more detailed insight into the conclusions of the recent molecular revolution I would recommend that you start with the Angiosperm Phylogeny Group's latest classification update (APGIII 2009). APG is an umbrella title for the very large group of scientists who have been working on documenting portions of flowering plant DNA to gain insights into the evolution and relationships of the members of this group. Such work will probably always be open to revision and correction and many ambiguities remain; within the British flora the most notable probably being the lack of consensus about the relationship of the Boraginaceae to other groups. People often feel that this sort (DNA sequence analysis) of molecular biology is an 'isolated' discipline with limited regard for the knowledge accrued using more traditional methods such as floral morphology, palynology or ecology; what is notable about the APG project is the extensive contribution of experts in such 'traditional' fields. Overall, the DNA revolution has emphasized how well scientists did in untangling relationships using non-molecular biological approaches and help to resolve long-standing conundrums and throw up surprises (such as plane trees, proteas and lotus being more closely related to each other than to other flowering plants). Regarding the organization of this paper, the families and genera of all groups are arranged following the arrangement in the *Flora*, species are arranged alphabetically.

Thank you to all of you who have contributed records for this report or who are participating in the London Flora Project. Although I make efforts to verify all information reported, it is inevitable that some errors will occur; in particular, please notify me if you are aware of identification, grid reference or location detail errors.

Nick Bertrand has on several occasions mentioned to me the joys of Woolwich Stadium (vc 16: TQ 426774). Nick became more familiar with the site after D. J. Nicolle reported to Rodney Burton in May 2008 that *Primula veris* **cowslip** has been seen on the site, from the top of a double-decker bus, 'in the hundreds at least'. As Nick said 'it [the presence of cowslips] seemed unlikely but in spring 2009 I went and had a neb. I was astonished. There were hundreds of Cowslips in full flower. . . . I had a good look round to see if a muppet had planted them but there was no evidence of this, au contraire all sorts of interesting things were present suggesting a surviving relict. Over the year I went back a few times and among the gems were *Betonica officinalis*, *Pimpinella saxifraga* (in abundance), *Centaurea nigra* (in abundance), *Lathyrus* *aphaca* (lots), *Lathyrus nissolia, Origanum vulgare* (in abundance). The final marvel the site had to offer revealed itself in the late summer, *Clinopodium calamintha* growing on a rough grassy bank, as it ought to be.' Nick has been back to visit the site several times over the last couple of years and has enthused to me about the value of the site and voiced concern for its future due to gradual encroachment by scrub and the spectre of 'development'. The presence of *C. calamintha* **lesser calamint** is particularly important as it is only the second known extant site for this nationally declining species in Greater London (the other being Lesnes Abbey).

FERNS AND ALLIES

Ophioglossaceae

Ophioglossum vulgare **adder's-tongue** was recorded in abundance from a field (vc 21: TQ160 838) on the LNHS botany trip, hosted by the Selborne Society, to Perivale Wood on 18 April. This plant seems to be slowly decreasing in much of the London Area, new records confirming its continued existence in known sites (particularly in Middlesex) would be most beneficial. As Rodney Burton mentioned (Burton 1983: 5), adder's-tongue is prone to disappearing for a number of years at a time so it is worthwhile checking locations with suitable habitat, preferably early in the year when the grass is not too long.

Pteridiaceae

The nationally native but regionally non-native *Adiantum capillus-veneris* **maidenhair-fern** was reported by John Edgington from two locations: a large colony along the street frontage of Nutford House, Brown Street (vc 21: TQ275813) and nearby houses, John first found this colony in 2007 since when the plants have spread further; John found another colony of similar extent in the front of 34–36 Sloane Court West. John also reported the non-native *Adiantum raddianum* **delta maidenhair-fern** from the following locations: several plants on the wall of a basement area at 1a Montague Place (vc 21: TQ298817); a colony on the wall of a basement area, Burton Place (vc 21: TQ299824), this was subsequently destroyed by renovation works; the basement area of 1 Millman Street (vc 21: TQ306821), this colony had apparently been destroyed by redecoration in 2008 but has now regrown. Nick Bertrand noticed an *Adiantum* growing on a railway bridge on Upper Marsh (vc 17: TQ 3096 7956) on 28 May; Nick was unable to identify the species as the plant was inaccessible, but he did send me a photo, from which I would tentatively suggest it is *A. capillus-veneris*.

The two recent cold winters seem to have killed or damaged some *Pteris* plants due to their general sensitivity to frost, nevertheless **brakes** still seem to be coming well-established and gradually spreading. A colony of *Pteris cretica* **Cretan brake** has been known since 2007 from a street wall at 17 Shouldham Street (vc 21: TQ274815); this colony was subsequently destroyed but a new plant has now appeared next door. John Edgington also reported a cristate variant of *P. cretica* on the wall of a basement at The Place, Duke's Road (vc 21: TQ298826).

Aspleniaceae

Asplenium adiantum-nigrum **black spleenwort** was recorded (*LNHS Newsletter* No. 217: 10) on an LNHS Botany Section meeting to Holland Park and North Kensington on a wall adjacent to the graveyard of St Mary Abbots (vc 21: TQ255797) led by John Swindells and myself on 27 February. The same species was also recorded as part of the London Flora Project monad survey scheme from Colindale (vc 21: 2189) and Oxford Street (vc 21: 2981). John Edgington also recorded *A. trichomanes* **maidenhair spleenwort** and *A. ruta-muraria* **wall**

rue from Euston (vc 21: TQ2982), Oxford Street (vc 21: TQ2981) and Somerstown (vc 21: TQ2983) whilst surveying for the London Flora Project. The former species was also recorded from Piccadilly (vc 21: TQ2980) by John whilst the latter was recorded from Colindale (vc 21: TQ2189) during the LNHS botany trip on 5 September.

Woodsiaceae

In early May 2010 I was given by Clive Schofield a small fertile frond of a fern that he had collected from a wall near his home in Islington (vc 21: TQ3283), unfortunately he was unable to remember exactly where it was found, but it was local. After some study and finally some assistance from Fred Rumsey at the Natural History Museum I was able to confirm that the plant was *Cystopteris fragilis* **brittle bladder-fern**. I believe this is the first record of this fern in Middlesex for a long time, probably since at least 1904 (Kent 2000: 99).

Blechnaceae

As I mentioned in my last report (Spencer 2010: 130) *Blechnum spicant* **hard-fern** was recorded by John Dobson whilst doing survey work in Stanmore Country Park (vc 21: TQ157941) on 8 July as an emergent plant following conservation work that exposed dormant spores. This location is not far from where Howard Matthews found a plant on Harrow Weald Common in 2008. Hard fern appears to be struggling in the London Area and is not one of the fern species that is apparently recovering in abundance and distribution to any great extent; overall, this is probably largely due to the relatively dry conditions experienced over most of the London Area, it is not surprising that it only seems to be able to survive away from the city's heat-island effect and in the higher rainfall areas of the NW of the region.

Dryopteridaceae

Holly-ferns seem to be steadily becoming increasingly well established in inner London; John Edgington reported two colonies: *Cyrtomium falcatum* **house holly-fern** was recorded by him in the basement area of Witley Court, Coram St (vc 21: TQ301822), these plants have been known since 2006. John also reported an inaccessible plant, high on a north-facing brick wall by a drainpipe at the junction of Savoy Hill and Savoy Way (vc 21: TQ305806); this was likely to be *C. fortunei* **Fortune's holly-fern,**

John Edgington found *Dryopteris carthusiana* **narrow buckler-fern** on the wall of a basement area, Museum Chambers, Little Russell Street (vc 21: TQ302815). This is John's first record from central London for this species which is scarce in the London Area and is largely restricted to ancient woodlands.

The non-native *Dryopteris cycadina* **shaggy buckler-fern** is becoming popular in horticulture and consequently is likely to increase as an escape. John Edgington found a sporeling low on a street wall at St Anne's Flats, Doric Way (vc 21: TQ297827). John commented that the first record from London was in St George's Gardens (vc 21: TQ304824) in 2002, where there is now a large colony of many plants.

Mary Smith updated Ken Adams's decade-old record for *Polystichum aculeatum* **hard shield-fern** from Thorndon Country Park; on 9 April, Mary found one plant on the side of a steep north-facing slope of a small gorge (vc 18: TQ62798951). A little later in the year, on 11 June, Mary found another plant, in poor condition, by a track at vc 18: TQ62868970. *Polystichum setiferum* **soft shield-fern** appears to be spreading rapidly in the London Area; most colonies are likely to have originated from nearby plantings, as this species is popular with landscape gardeners due to its durability. John Edgington reported it from the following locations: a wall on Taviton Street, Endsleigh Gardens (vc 21: TQ296824); Guilford Street at Lansdowne Terrace (vc 21: TQ304821); behind a drainpipe, 25 John Street (vc 21: TQ308820). A likely native record came from John Dobson during his survey of Stanmore Country Park (vc 21: TQ155938) where he recorded two large plants on 18 May. A shield-fern from Carshalton Methodist Church (vc 17: TQ27946420) that had given some confusion over its identity was determined by Howard Matthews as *P. setiferum* on 4 February.

FLOWERING PLANTS – EUDICOTYLEDONS

Papaveraceae (including Fumariaceae)

Fumaria officinalis ssp. *wirtgenii* **common fumitory** was recorded (*LNHS Newsletter* No. 219: 9) on John Swindells's 'Pot luck in the East End' LNHS Botany Section meeting to Whitechapel and Bethnal Green on 29 June. John Edgington found the same subspecies growing on waste ground west of Bayham Street (vc 21: TQ291837). Stace (2009: 94) comments that this subspecies is probably more common on light soils in eastern England than ssp. *officinalis*; as I mentioned in my last report (Spencer 2010) recording to subspecies level can provide valuable information, I have no double that ssp. *wirtgenii* is more common in the London area than our scant records would indicate.

Berberidaceae

John Edgington recorded a plant of *Mahonia aquifolium* **Oregon-grape** growing out of a wall at Montague Place (vc 21: TQ298817). There are several widespread garden hybrids and selections of *Mahonia* species available via the horticultural trade, some records for *M. aquifolium* may prove to be one of these, the most likely being *M. japonica* or *M.* × *wagneri,* a hybrid with *aquifolium* as one of the parents. Seedlings of *Mahonia* regularly appear in flowerbeds in the area where I live alongside tree-of-heaven seedlings; the former rarely persist and fall victim to the council's garden maintenance contractors, unlike the latter (which, rather perversely, the contractors seem to be fond of leaving).

Ranunculaceae

Clematis tangutica **orange-peel clematis** was recorded from the Greenwich peninsula (vc16: TQ402789) on the LNHS Botany Section meeting along the riverside from Greenwich to Deptford led by Nick Bertrand on 11 July (*LNHS Newsletter* No. 219: 10).

Mary Smith reported a colony of several hundred plants of *Ranunculus parviflorus* **small-flowered buttercup** from over-grazed water-meadow on Davy Down (vc 18: TQ59048019) near the Mar Dyke on 3 June. I have no recent records of this species from Middlesex and all other records from the London Area for this species seem to be restricted to Surrey and near Upminster.

John Edgington recorded *Anemone blanda* **Balkan anemone** as 'regenerating freely in St James's Gardens' (vc 21: TQ293827); I have no reason to doubt John's record but care should be taken to ensure that this species is not mixed up with *A. apennina* **blue anemone** (the undersides of the sepals and basal leaves of the latter are hairy, not smooth). It would appear from the BSBI map scheme (http://www.bsbi.org.uk/) that blue anemone is the more widespread in the London Area.

Colin Bowlt contributed two *Helleborus* records in 2010. The first was for a non-native occurrence of *H. foetidus* **stinking hellebore** from near the River

Pinn, Eastcote (vc 21: TQ103884) on 19 January. The second record was a very useful follow-up visit to the only known native site for *H. viridis* **green hellebore** in Middlesex. The plant has long been known from Downe Barns Moat, Northolt (vc 21: TQ109838) and was first discovered there over two centuries ago (Kent 1975: 151). Colin recorded the plant from 'the western and northern banks inside the moat' and mentioned that 'comparison of the mapping of the plants in 2007 and 2008 shows no change — which is what you might expect for plants that have been there for 200 years'.

Saxifragaceae

A single plant of *Tellima grandiflora* **fringecups** was recorded from the north-eastern boundary of Oxleas Wood (*LNHS Newsletter* No. 218: 5) on an LNHS Botany Section meeting to Oxleas Wood led by John Swindells on 18 May. Probably self-sown fringecups was also found by John Edgington among grass in St James's Churchyard, Piccadilly (vc 21: TQ293804) having escaped from flowerbeds where it is no longer present; John also reported it as similarly naturalized in St Andrew's Gardens (vc 21: TQ307823).

Nick Bertrand has commented on several occasions in recent years that *Saxifraga tridactylites* **rue-leaved saxifrage** seems to be increasing in abundance in south London, particularly on stabilized railway track bedding. In 2010 he recorded a few plants on raised concrete in front of the ambulance station on Waterloo Road (vc 17: TQ31397966) as well as a large colony on a cobbled area next to the ramp leading to a car park, Tyers Road, Vauxhall (vc 17: TQ30727856).

Crassulaceae

Umbilicus rupestris **navelwort** seems to be slowly increasing in inner London (Spencer 2008: 181) in a manner that is reminiscent of various ferns, particularly *Asplenium* species. Stephen McNee reported a single plant from a location in Soho (vc 21: TQ295807) on 15 March. Nick Bertrand reported navelwort from the base of a garden fence on Tyers Road, Vauxhall (vc 17: TQ30747858).

Fabaceae

Anthyllis vulneraria **kidney vetch** was recorded (*LNHS Newsletter* No. 218: 7) on an LNHS Botany Section meeting to London Zoo, Regent's Park led by George Hounsome and Sven Seiffert on 23 May. George hopes to visit the Zoo again in the future and hopefully he will be able to gain access to the green roof on which the vetch was planted and identify which subspecies the plant is (see my comments on subspecies in my previous LNHS report: Spencer 2010).

On 7 June, Mary Smith found eight plants of *Lathyrus sativus* **Indian pea** in rough grass between planted broom on the edge of a landfill site at Launders Lane, Rainham (vc 18: TQ54898260).

A few days earlier, on 3 June, Mary Smith discovered two small plants in flower of *Trifolium glomeratum* **clustered clover** in dry soil between the pavement and garden wall on Fairham Avenue, South Ockendon (vc 18: TQ582809); she felt that the plants would 'succumb to herbicide later' and therefore considered them to be casual.

Rosaceae

In my last report (Spencer 2010: 128) I mentioned that escaped and naturalized *Alchemilla mollis* **garden ladies-mantle** seemed rather infrequent in the London Area compared to other parts of the country; *Alchemilla* species are generally upland plants: is London too hot and dry for them to thrive? John Edgington recorded several plants among paving (a frequently preferred habitat) along Dark House Walk (vc 21: TQ330805); does anyone know of a more well-established escapee location in grassland/scrubland for this species? Whilst discussing *Alchemilla*, I would also appreciate records for any of the native members of the *A. vulgaris* group, particularly for *A. filicaulis* ssp. *vestita* **hairy ladies-mantle** or *A. xanthochlora* **pale ladies-mantle**.

Cotoneaster obtusus **Dartford cotoneaster** appears to be locally frequent in the part of Islington where I live; it can be seen at several points along Amwell Street, Claremont Square and on top of a wall at Myddelton Passage (vc 21: TQ3125382665; TQ3113583038; TQ3133082836). Following a fungal foray in Holland Park in late October I also found it bordering a footpath running alongside the north-east border of the park (vc 21: TQ2483180050).

Eriobotrya japonica **loquat** was recorded (*LNHS Newsletter* No. 218: 6) on an LNHS Botany Section meeting to London Zoo, Regent's Park led by George Hounsome and Sven Seiffert on 23 May. The same species was also found by me on the Regent's Canal during a square-bashing exercise in TQ3283 on 17 June.

Chris Rose found several plants of *Potentilla argentea* **hoary cinquefoil** in a car park on Hospital Road, Hounslow, near the junction with Staines Road (vc 21: TQ1325475493); this is an excellent find for a plant that I believe is going through a severe and largely undocumented decline; recent records for this plant in the London Area would be most welcome. Following on from a request for information by me, Juliet Cairns went and checked the known site for this plant at Holwood Meadows, Keston on 7 June; she found one plant in bare ground near the old cricket field entrance (vc 16: TQ421636): it seems to be in rather a precarious position in the area. Juliet also investigated a site in Kidbrooke (vc 16: TQ4085575207), to no avail, where I saw it whilst doing survey work for the London Wildlife Trust and the GLA in 2002. *Potentilla indica* (formerly *Duchesnea indica*) **yellow-flowered strawberry** was recorded (*LNHS Newsletter* No. 217: 10) on an LNHS Botany Section meeting to Holland Park and North Kensington behind Kensington library (vc 21: TQ25427961) led by John Swindells and myself on 27 February.

Members of the genus *Sorbaria* are not reliably identifiable without mature fruiting material. Aware of this, John Edgington was able to confirm the identity of seedlings in pavement cracks at Queen Square (vc 21: TQ303820) as *Sorbaria tomentosa* by checking the fruit on a mature specimen nearby in the Square garden which was, in all likelihood, the origin of these young plants.

Stranvaesia davidiana **stranvaesia** was recorded (*LNHS Newsletter* No. 218: 6) on an LNHS Botany Section meeting to Keston Common, Bromley led by Fred Rumsey on 14 February.

Rhamnaceae

John Edgington found a young, prostrate plant of a *Ceanothus* **California lilac** growing from a crack on the doorstep of 147 Grays Inn Road (vc 21: TQ307823); this he tentatively determined as *Ceanothus* cf. *thyrsiflorus*, with the assistance of Eric Clement. As John said, it was presumably seeded from a parent plant in nearby gardens. I found several young *Ceanothus* plants whilst out with Nick Bertrand in the docklands several years ago, so it is likely that more individuals may turn up and it is possible that not all 'wild' material is planted as is usually supposed.

Urticaceae

Another colony of *Urtica membranacea* **membranous nettle** turned up at yet another Greater London site (see Spencer 2010: 129–130 for previous records); this time it was recorded by John Swindells in a raised flower bed on the junction of Fore Street and Wood Street, Barbican (vc 21: TQ324816). By the time the LNHS Botany Section visited on 22 June the site had been weeded and there was only one survivor (*LNHS Newsletter* No. 218: 13). Further new confirmed sites include John Edgington's report of it from the garden of the Ritz Hotel beside Queen's Walk, Green Park (vc 21: TQ290802) as well as 'three plants together, one in flower, on gravel underneath shrub-planted containers outside . . . 65 South Audley Street' (vc 21: TQ28378050) on 10 February by John Hughes. Finally in June, Roy Vickery found about five plants growing 'in crack between pavement and garden wall of No. 167 (next to The Selkirk pub)' on Fishponds Road, Tooting (vc 17: TQ274717). Later in the year, on 13 November, Roy contacted me to let me know that the 'Tooting colony looks to be well established with quite a number of young plants when I last checked, about a month ago'.

John Edgington's confirmed (by Fred Rumsey and myself) record of *Parietaria officinalis* **eastern pellitory-of-the-wall** from the Regent's Canal towpath at St Pancras Basin (vc 21: TQ298836) caused a minor flurry of additional records, largely instigated by my enthusiasm; sadly they were all wrong and proved to be the widespread *P. judiaca* **pellitory-of-the-wall.** This is only the third record for the British Isles according to Stace (2009: 286); Nevertheless, I am reasonably certain that *P. officinalis* may be more widely established, but following Fred's [informal] assessment of the characters used for identification, I believe that the leaf and petiole features mentioned in Stace and in John Poland's vegetative key (Poland and Clement 2009: 162) are not overly helpful for diagnosis. Fred is of the opinion that the most valuable features are whether the floral bracts (these have the appearance of sepals in *Parietaria*) are free (*P. officinalis*) or fused (*P. judiaca*), and perianth shape. Confusingly, Stace, and Poland and Clement are at variance with each other on the bract fused/not fused character; until advised otherwise, I will follow Stace in this matter.

Euphorbiaceae

John Edgington recorded *Euphorbia characias* ssp. *veneta* (formerly ssp. *wulfenii*) **Mediterranean spurge** as a self-sown plant on top of a wall near flower beds where it had been planted at St George's Gardens (vc 21: TQ304824). On 5 May, Nick Bertrand found the other subspecies of Mediterranean spurge (ssp. *characias*) also growing in the wall of a small park off Guy Street (vc 17: TQ32947982). Mediterranean spurge seems very keen on walls in this country, I have noticed it on various walls across southern England over the last few years doing very well; no doubt it escapes the rigours of glyphosate and benefits from the extra warmth. I mentioned in my last report (Spencer 2010: 122) that *Euphorbia oblongata* **Balkan spurge** seemed to be increasing. On 7 June, Mary Smith found three patches on a landfill site on the west side of Launders Lane, Rainham (vc 18: TQ54428226). These plants were, according to Mary, 'visible from road but hard to reach a bit (just did it, risking my neck for id!)', no doubt a marvellous trail of health-and-safety paperwork was done to keep all concerned happy.

Violaceae

For such a frequently grown plant, records for escaped *Viola* × *wittrockiana* **garden pansy** are few and far between; this is probably largely due to their ephemeral nature as they usually succumb to the council weedkillers, nevertheless, I do believe it is useful to record these occurrences. John Edgington found a garden escape in a pavement crack, Frith Street (vc 21: TQ297811).

Hypericaceae (Clusiaceae in previous reports)

In my last Botany Report (Spencer 2010: 122) I mentioned that *Hypericum hircinum* **stinking tutsan** seemed to be spreading eastward from its core territory. John Edgington found it to be 'abundant and increasing along the perimeter wall of Marlborough House, facing The Mall, and also in bare ground at the foot of the wall' (vc 21: TQ295800). *Hypericum maculatum* **imperforate St John's-wort** was recorded from the south-western boundary of Oxleas Wood (TQ440758) on an LNHS Botany Section meeting led by John Swindells on 18 May (*LNHS Newsletter* No. 218: 6). Although unrecorded, it is likely that the plant was ssp. *obtusiusculum*, the much more widespread subspecies.

Passifloraceae

Passiflora caerulea **blue passionflower** did not make it into the third edition of Stace's *New flora of the British Isles*. I suspect it will need to be included in future works; in addition to the locations I mentioned in my last report (Spencer 2010: 126), John Edgington recorded it from neglected and weedy soil on the north side of Drummond Street (vc 21: TQ294836).

Sapindaceae (including Aceraceae and Hippocastanaceae)

Various non-native species of *Acer* are gradually establishing themselves across London, some of which go unrecorded due to uncertainty about their planted/non-planted status; I would advise recording them where an identification is possible and making a comment such as 'possibly planted'. John Edgington recorded *Acer negundo* **ashleaf maple** as regenerating from seed on Royal College Street (vc 21: TQ294835); he also noted *Acer saccharinum* **silver maple** regenerating from seed on Camley Street (vc 21: TQ297837). *Acer cappadocicum* **Cappadocian maple** was recorded from Colindale (vc 21: TQ2189) during the LNHS botany trip on 5 September. My former colleague at the Natural History Museum, Martin Christenhusz, recorded *Acer mono* from Alexandra Park whilst taking part in the OPAL Bioblitz on 5 June.

Malvaceae

Dave Dawson reported a very interesting record of an unknown malvaceous herb growing 'in a roadside "lawn" rich in wasteland species just opposite the proposed new US Embassy site in Nine Elms' (vc 17: TQ297776). Dave commented that it has been established for at least three years. Material was sent to Christopher Davis from the Natural History Museum for determination who identified it as *Modiola caroliniana* **bristly-fruited mallow.**

During the LNHS Botany trip to Coppett's Wood (vc 21: TQ275914) led by David Bevan on 18 July both *Malva moschata* **musk-mallow** and *Malva alcea* **greater musk-mallow** were recorded. These plants have been long established at this site (the latter known here since at least 1984) and are probably benefitting from the increased alkalinity in the soil caused by the placement of rubble and hardcore to maintain pathways. Although *M. moschata* is locally frequent in suitable habitat in the London Area, *M. alcea* remains a scarce (and usually casual) plant; the most recent record I am aware of was from Goods Way, King's Cross several years ago.

Brassicaceae

Camelina sativa **gold-of-pleasure** was recorded (*LNHS Newsletter* No. 219: 7) on an LNHS Botany Section meeting to Beddington farmlands/sewage farm (vc 17: TQ2966) led by Derek Coleman on 20 June. This now rather scarce casual can indeed cause 'head-scratching' as reported by Ian Kitching in his *Newsletter* report; care should be taken when deciding which species of *Camelina* has been found as several have been recorded in the British Isles and all require very careful assessment of the fruit characters (Stace 2009: 394).

I have accidentally omitted from my previous reports two interesting records for *Cardamine corymbosa* **New Zealand bitter-cress**. The first was from Michael Braithwaite who recorded it in 2007 from a flower-bed in St James's Park (vc 21: TQ292796); the second was a record made by myself from Postman's Park, King Edward Street (vc 21: TQ320814). These plants I showed to the LNHS Botany group shortly after on 2 February 2009. I had thought that the St James's Park record was the first for Middlesex but Aaron Wood recorded it from Camden Town (vc 21: TQ2983) in 2002; I wonder, is it still there? During 2010 John Edgington found it to be abundant in paving cracks at Pied Bull Yard off Bury Place (vc 21: TQ302816). This plant is likely to become fairly widespread as a weed in public spaces but can be tricky to spot due to its small size; the best time is probably in late winter when it is starting to flower and can be spotted before other plants start active growth.

Descurainia sophia **flixweed** was recorded (*LNHS Newsletter* No. 218: 12) on an LNHS Botany Section meeting to Hackney Marshes and Wick Woodland led by Russell Miller on 12 June. A single plant was also recorded on the LNHS Botany Section meeting (*LNHS Newsletter* No. 219: 7) to Beddington farmlands/sewage farm (vc 17: TQ2866) led by Derek Coleman on 20 June. John Edgington found flixweed on pavements in two nearby streets: Frederick Street (vc 21: TQ306826) and Mecklenburgh Street (vc 21: TQ306824). I had also found it at the latter site in 2009.

Just like rue-leaved saxifrage, members of the *Erophila verna* **spring whitlow-grass** group seem to be gaining ground in suitable habitats in inner London. So far I have only recorded *E. verna* as I did on 11 April in Claremont Square, Clerkenwell (vc 21: TQ31218305) but *E. majuscula* may turn up in more-calcareous areas whereas *E. glabrescens* (apparently the least common species) could be lurking alongside *E. verna* or in similar habitats.

Almost certainly planted specimens of *Isatis tinctoria* **woad** were recorded, in the company of *Dipsacus laciniatus* **cut-leaved teasel** and *Levisticum officinale* **lovage** (*LNHS Newsletter* No. 219: 9), on John Swindells's 'Pot luck in the East End' LNHS Botany Section meeting to Whitechapel and Bethnal Green from a front garden on Underwood Road (vc 21: TQ342820) on 29 June. Recording planted material is a matter of constant debate amongst those who record; to some it is anathema, others take great pleasure in it. What I would plead is that if you do record planted material, please note your observations. In this particular case, the advent of any of these three species on nearby streets over the next few years may be linked to this record.

Lepidium latifolium **dittander** was recorded from the Greenwich peninsula (vc 17: TQ40167896) on the LNHS Botany Section meeting along the riverside from Greenwich to Deptford led by Nick Bertrand on 11 July (*LNHS Newsletter* No. 219: 10). Although absent or scarce over much of London, dittander can be locally abundant near the Thames in eastern parts of the London Area and appears to be increasing. Mary Smith recorded dittander from a car park in Thorndon Country Park (vc 18: TQ6389) on 29 April and from two patches on landfill sites on Launder's Lane, Rainham (vc 18: TQ5482) on 7 June. Mary also commented that she has seen dittander in nine other monads since 2000 although only one was 'near the Thames coast on disturbed sandy soil, most of the others in [were in] landfill sites', she also commented that 'none have been seen by salted roads' and that it is 'hard to decide whether these sites are native or established alien, but probably the latter'.

Nick Bertrand reported that Chris McGaw found a mysterious *Rorippa* at Brockley and Ladywell Cemetery (vc 16: TQ36987488) in August 2010 that after some struggling they decided was *Rorippa* × *armoracioides* **Walthamstow yellow-cress**. This would appear to be a first county record for West Kent, a voucher for confirmation and reference would be highly desirable.

Sisymbrium altissimum **tall rocket** was recorded (*LNHS Newsletter* No. 218: 12) on an LNHS Botany Section meeting to Hackney Marshes and Wick Woodland led by Russell Miller on 12 June. Several specimens of the same species were also recorded (*LNHS Newsletter* No. 219: 7) on an LNHS Botany Section meeting to Beddington farmlands/sewage farm (vc 17: TQ2966) led by Derek Coleman on 20 June. *Sisymbrium irio* **London rocket** was recorded (*LNHS Newsletter* No. 218: 7) on an LNHS Botany Section meeting to London Zoo, Regent's Park led by George Hounsome and Sven Seiffert on 23 May. This plant has been known from this site for quite some time as it has been from Kensington Court where it was recorded (*LNHS Newsletter* No. 217: 10) on an LNHS botany section meeting to Holland Park and North Kensington (vc 21: TQ258795) led by John Swindells and myself on 27 February. It was also recorded (*LNHS Newsletter* No. 219: 8) on John Swindells's 'Pot luck in the East End' LNHS Botany Section meeting to Whitechapel and Bethnal Green in a car park on New Road and Vine Street (vc 21: TQ336810) on 29 June (see Spencer 2008: 180 for further locations).

Polygonaceae

Rumex palustris **marsh dock** was recorded (*LNHS Newsletter* No. 219: 7) on an LNHS Botany Section meeting to Beddington farmlands/sewage farm by the edge of a pond (vc 17: TQ2866) led by Derek Coleman on 20 June; on 18 July the same site was visited by the London Bird Club and material from plants that appeared to be the hybrid, *R.* × *steinii*, with *R. obtusifolius* **broad-leaved dock** was collected. *R. palustris* was also recorded at Gallions Reach (vc 18: TQ4431580869. Note: this location is in the vice-county of West Kent even though it is on the north bank of the Thames due to an historic 'anomaly') on an LNHS Botany Section walk led by John Edgington on 24 July. A little earlier that month, Geoffrey Kitchener located and identified a plant of *R* × *lousleyi* (*R. cristatus* × *R. obtusifolius*) from the Greenwich peninsula (vc 17: TQ3988379167) on the LNHS Botany Section meeting along the riverside from Greenwich to Deptford led by Nick Bertrand on 11 July (*LNHS Newsletter* No. 219: 10). I collected some material that made a sufficient specimen for the herbarium at the Natural History Museum.

Fallopia sachalinensis **giant knotweed** was recorded during the LNHS Botany trip to Coppetts Wood (vc 21: TQ275914) led by David Bevan on 18 July. This species is much scarcer in Middlesex that its well-known relative *F. japonica* **Japanese knotweed**; between them, they produce *F.* × *bohemica* which was recorded during the OPAL Bioblitz from Alexandra Palace on 5 June.

Caryophyllaceae

Dianthus carthusianorum **Carthusian pink** was recorded from two localities in 2010, both associated with habitat-creation schemes along or near the Thames pathway. The first was at Woolwich Arsenal (vc 16: TQ436793) where it was recorded on an LNHS Botany Section walk led by Nick Bertrand on 11 July (*LNHS Newsletter* No. 219: 10). It was also recorded at Gallions Reach (vc 16: TQ443806) on an LNHS Botany Section walk led by John Edgington on 24 July (where it was first found by John in 2009; see Spencer 2010: 121).

Myosoton aquaticum **water chickweed** was recorded (*LNHS Newsletter* No. 218: 6) on an LNHS Botany Section meeting to London Zoo, Regent's Park led by George Hounsome and Sven Seiffert on 23 May. This plant is rather scarce over much of the urbanized parts of Middlesex and new records from these areas are always of interest.

Saponaria ocymoides was found as a garden escape by John Edgington in Frederick Street (vc 21: TQ306826). This is a rather scarce casual and rarely persists but may do so on walls or sparsely vegetated banks.

Montiaceae (formerly within Portulaceae)

Claytonia perfoliata **spring-beauty** was recorded (*LNHS Newsletter* No. 217: 10) on an LNHS Botany Section meeting to Holland Park and North Kensington in the graveyard of St Mary Abbots (vc 21: TQ255797), led by John Swindells and myself on 27 February.

In the London Area *Montia fontana* **blinks** seems to be entirely represented by ssp. *chondrosperma*; identification requires a little patience in teasing out the seed, and good eyesight or a lens to study the surface sculpturing of the fruit to be certain which of the four British subspecies is in hand. Nick Bertrand recorded blinks 'in abundance beneath a tree in front of the football centre on East Parkside, Greenwich Peninsula' (vc 17: TQ39527962); this is a most unusual location as, in my experience, it seems limited to ancient habitats, not newly establish tree plantings. In 2010 I saw blinks at the following locations: Crescent Wood Road, Upper Sydenham (vc 17: TQ3437372284); under sycamore trees alongside a thriving colony of *Oenanthe pimpinelloides* **corky-fruited water-dropwort**; Buck Hill, Kensington Gardens (vc 21: TQ267804), and finally in a field (vc 21: TQ15898358) on the LNHS botany trip, hosted by the Selborne Society, to Perivale Wood on 18 April.

Primulaceae

Mary Smith and Bob Creber recorded *Hottonia palustris* **water-violet** from The Manor LNR, Dagnam Park (vc 18: TQ54539292) and a small patch of about ten flowering shoots at Hatters Wood N pond (vc 18: TQ548927) on 5 May; later in the year, on 19 August, 'water levels were low and large numbers of plants were [seen] on mud or as floating pieces over much of the pond'.

Rubiaceae

Galium verum ssp. *wirtgenii* **lady's bedstraw** was recorded from two localities in 2010, both associated with the same habitat creation schemes along or near the Thames pathway that produced *Dianthus carthusianorum*. The first was at Woolwich Arsenal (vc 16: TQ436793) where it was recorded on an LNHS Botany Section walk led by Nick Bertrand on 11 July (*LNHS Newsletter* No. 219: 10). It was also recorded at Gallions Reach (vc 16: TQ443806) on an LNHS Botany Section walk led by John Edgington on 24 July. Voucher material from the latter site is now at the Natural History Museum.

Boraginaceae

Juliet Cairns produced an interesting record of *Amsinckia micrantha* **common fiddleneck** from the Cator Estate, Blackheath (vc 16: TQ400762) on 28 June. Although very well established in East Anglia and further north this plant still seems relatively scarce in the London Area.

Echium vulgare **viper's-bugloss** was found in the same location as *Malva moschata* during the LNHS Botany trip to Coppetts Wood (vc 21: TQ275914) led by David Bevan on 18 July. This too is probably benefitting from the increased alkalinity in the soil caused by the placement of rubble and hardcore to maintain pathways.

John Edgington recorded a large well-naturalized population of *Symphytum grandiflorum* **creeping comfrey** amongst rough grass in St Andrew's Gardens (vc 21: TQ307823).

Solanaceae

Atropa belladonna **deadly nightshade** was recorded (*LNHS Newsletter* No. 217: 9) on an LNHS Botany Section meeting to Holland Park and North Kensington, in a private car park on Aubrey Road (TQ247802), led by John Swindells and myself on 27 February.

Oleaceae

A seedling of *Fraxinus ornus* **manna ash** was recorded (*LNHS Newsletter* No. 218: 7) on an LNHS Botany Section meeting to London Zoo, Regent's Park led by George Hounsome and Sven Seiffert on 23 May.

Plantaginaceae

John Edgington recorded a few plants of *Plantago major* ssp. *intermedia* **greater plantain** from the base of a wall at the south end of Torrington Square (vc 21: TQ298819); he also recorded it from Regent's Canal towpath at Maiden Lane Bridge (vc 21: TQ303835). Subspecies *intermedia* is rarer than the very common ssp. *major* and requires some care in identification (see Stace 2009: 599); however, it does seem to be rather more salt tolerant than the latter, so salted roadsides may be a good place to look in the London area.

Scrophulariaceae

After much discussion about stamen morphology several plants of mullein were confirmed to be *Verbascum speciosum* **Hungarian mullein**; these were recorded near the Thames towpath (vc 17: TQ4166579312) on the LNHS Botany Section meeting along the riverside from Greenwich to Deptford led by Nick Bertrand on 11 July (*LNHS Newsletter* No. 219: 10).

Lamiaceae

Clinopodium vulgare **wild basil** was found in the same location as *Malva moschata* and *Echium vulgare* during the LNHS Botany trip to Coppetts Wood (vc 21: TQ275914) led by David Bevan on 18 July. Although the other mentioned species were well known to David at this site, this was a new find and very satisfying for him too!

Betonica officinalis **betony** is now a very scarce plant over much of the Greater London area and is largely extirpated in Middlesex. Therefore it was very pleasing to hear that John Dobson had recorded it from three localities on Stamore Common (The Aspens: TQ1568994071; Oakmead: TQ1578993903; Bluebell Heath: TQ1585094120) during his survey in 2010.

A seedling of *Stachys byzantina* **lamb's-ear** was recorded (*LNHS Newsletter* No. 218: 6) on an LNHS Botany Section meeting to London Zoo, Regent's Park led by George Hounsome and Sven Seiffert on 23 May.

Paulowniaceae (formerly Scrophulariaceae)

Paulownia tomentosa **foxglove-tree** seedlings (see Spencer 2008: 188–9) were recorded from the Barber-Surgeons' herb garden (TQ322816) on the LNHS Botany Section meeting to The Barbican led by John Swindells on 22 June (*LNHS Newsletter* No. 218: 13).

Orobanchaceae

Orobanche hederae **ivy broomrape** was recorded from the Thames Pathway (vc 16: TQ424793) on the LNHS Botany Section meeting along the riverside from Greenwich to Deptford led by Nick Bertrand on 11 July (*LNHS Newsletter* No. 219: 10).

John Edgington reported *Orobanche hederae* **ivy broomrape** growing along Camley Street and the railway side, just south of the obliquely aligned railway bridge over the Regent's Canal (vc 21: TQ298836). Although these plants were growing in mixed scrub with ivy present I suspect they may be the form of *O. minor* that favours buddleia which also grows abundantly at the site; *O. minor* (the buddleia-loving variant) grows nearby in the absence of ivy at Camley Street Natural Park. Confirmation of John's record will require a further visit.

Acanthaceae

Acanthus mollis **bear's-paw** is rather frequently found as a garden throw-out due to its vigorous nature, evidence of regeneration by seedlings is infrequent; John Edgington saw such evidence at St James's Gardens (vc 21: TQ293827).

Campanulaceae

Pratia pedunculata **lawn lobelia** was recorded in a lawn at Jordans Way, Rainham (vc 18: TQ53778329) on 7 July, by Mary Smith who described 'lots of plants in one lawn have escaped a long way into the neighbour's lawn, including [car] runway and path edges'.

Asteraceae

Ambrosia artemisiifolia **ragweed** is considered a pernicious, allergenic, invasive weed in southern Europe, but as yet it does not seem to be established here and most (all?) occurrences appear to be casual; Juliet Cairns recorded it from a path side west of Surrey Water (vc 17: TQ3563979980) on 19 September.

Carduus tenuiflorum **slender thistle** was recorded (*LNHS Newsletter* No. 218: 12) on an LNHS Botany Section meeting to Hackney Marshes and Wick Woodland led by Russell Miller on 12 June.

Centaurea jacea **brown knapweed** was recorded from two localities in 2010, both associated with the same habitat-creation schemes along or near the Thames pathway that produced *Dianthus carthusianorum* and *Galium verum* ssp. *wirtgenii*. The first was at Woolwich Arsenal (vc 16: TQ436793) where it was recorded on an LNHS Botany Section walk led by Nick Bertrand on 11 July (*LNHS Newsletter* No. 219: 10). It was also recorded at Gallions Reach (vc 16: TQ443806) on an LNHS Botany Section walk led by John Edgington on 24 July, voucher material from both sites is now at the Natural History Museum. It is possible that no pure *C. jacea* now exists in this country (or is very rare) and all material should be referred to its hybrid with *C. nigra* or *C. debeauxii* (*C.* × *gerstlaueri*, formerly known as *C.* × *moncktonii*); however, I have compared the voucher material from Woolwich and Gallions Reach with material held at the Natural History Museum and I am reasonably satisfied that the plants from these locations are best treated as *C. jacea*, although there may be some signs of introgression with the Gallions Reach material (see Stace 2009: 700). Overall, the presence of *Centaurea jacea*, *Dianthus carthusianorum* and *Galium verum* ssp. *wirtgenii* strongly indicate a non-native origin for the seed mix that was used by the relevant agencies when landscaping the Woolwich and Gallions Reach sites; this is very unfortunate and should not continue, doubtless it will though! John Edgington recorded *C. debeauxii* **chalk knapweed** from a lawn along The Mall below Carlton House Terrace (vc 21: TQ296802); it is likely that this was introduced to this locality.

Cirsium arvense var. *vestitum* **creeping thistle** was recorded from the Greenwich peninsula (vc 17: TQ4001879022) on the LNHS Botany Section meeting along the riverside from Greenwich to Deptford led by Nick Bertrand on 11 July (*LNHS Newsletter* No. 219: 10); the plant was determined as such by Ian Kitching and George Hounsome on their return home.

John Edgington recorded several plants of *Erigeron acris* **blue fleabane** in flower along a roadside outside the Construction Industries College, Gallions Reach (vc 16: TQ441804).

Senecio inaequidans **narrow-leaved ragwort** was recorded (*LNHS Newsletter* No. 218: 12) on an LNHS Botany Section meeting to Hackney Marshes and Wick Woodland led by Russell Miller on 12 June. This non-native plant is now locally frequent in this part of Greater London (see Burton 2007: 176; Spencer 2008: 178). On the same LNHS botany meeting led by Nick Bertrand that turned up *C. jacea* at Woolwich an interesting *Senecio* that in general habit resembled *S. squalidus* **Oxford ragwort** but with very narrow leaves somewhat similar to *S. inaequidans* was found at Lovells Wharf (vc 17: TQ 39187846); some discussion about a possible hybrid origin followed but the matter remained unresolved on the walk. On returning home, Ian Kitching and I attempted to key the plant out using 'Stace 3'; for both of us the result was *S. cambrensis* **Welsh ragwort**, a result that I rejected straightaway as I'm familiar with the plant from herbarium material held at the Natural History Museum. I showed the plant to my colleague Fred Rumsey who agreed with me that the plant was not *S. cambrensis,* but like me he was baffled as to its true identity.

A thriving colony of a **hawkweed** *Hieracium* sp. was recorded from an old wall by the Barber-Surgeons' herb garden (vc 21: TQ322816) on the LNHS Botany Section meeting to The Barbican led by John Swindells on 22 June (*LNHS Newsletter* No. 218: 13). A specimen has been sent to the Natural History Museum, London for identification (see my comments regarding *Hieracium* in Spencer 2010: 120).

These days *Galinsoga parviflora* **gallant-soldier** appears to be vastly outnumbered across most of London by *G. quadriradiata* **shaggy-soldier**; historically this was not the case and for many decades gallant-soldier appears to have been the more common (judging by our herbarium collections at the Natural History Museum). What has caused the apparent turn-around? I have only once seen gallant-soldier in inner London in recent years, courtesy of Nick Bertrand who showed it to the LNHS Botany group near Waterloo several years ago. Thus, it was interesting to receive John Edgington's report of *G. parviflora* from a flower bed on a road island at the west corner of Russell Square (vc 21: TQ300820); as John says, 'The only example of the species I've noticed in London — I put most down as *G. quadriradiata* without paying them enough attention', something most of us do, but it is worthwhile checking occasionally!

About a hundred flowering plants of *Gnaphalium luteoalbum* **Jersey cudweed** were recorded by John Edgington from a rubbish-strewn paved area just off Cubitt Street (vc 21: TQ326808) in June, by 26 July 'the rubbish had been cleared and the whole area stripped bare'. As I mentioned in my last report (Spencer 2010: 119–120), this plant seems to be spreading and increasing in abundance across southern England at the moment.

In the same car park as deadly nightshade (see above) was recorded (*LNHS Newsletter* No. 217: 9), on the LNHS Botany Section meeting to Holland Park and North Kensington led by John Swindells and myself on 27 February, several young plants of *Helichrysum petiolare* were found; these were subsequently killed by the cold winter of 2010/11.

The non-native perennial subspecies of **nipplewort** *Lapsana communis* ssp. *intermedia* was recorded by John Edgington growing in cracks in the tarmac of a car park, Vernon Rise (vc 21: TQ308828) where it has been known for many years.

Caprifoliaceae

Sambucus ebulus **Danewort** was recorded (*LNHS Newsletter* No. 218: 6) on an LNHS Botany Section meeting to Hackney Marshes and Wick Woodland led by Russell Miller on 12 June. The area is a well-known locale and stronghold for this species, but large chunks of the population have been lost to the 2012 Olympics development.

Araliaceae

A mature, self-sown seedling of *Fatsia japonica* **fatsia** was recorded (*LNHS Newsletter* No. 217: 10) on an LNHS Botany Section meeting to Holland Park and North Kensington in the graveyard of St Mary Abbots (vc 21: TQ255797) led by John Swindells and myself on 27 February.

MONOCOTYLEDONS

Alismataceae

For me, the highlight of the Botany trip to Coppetts Wood and the Glebelands led by David Bevan on 18 July was an opportunity to visit the only known extant site for *Baldellia ranunculoides* **lesser water-plantain** in Greater London and one of the few surviving in south-east England outside the Surrey heaths. As I mentioned in my last report (Spencer 2010: 118) it was desirable to check which subspecies was present, the plants proved to be ssp. *ranunculoides* the more widespread of the two (the other being ssp. *repens* which is largely western in distribution). During the visit I did a count and estimated that there were about twenty-three distinct patches; this is a considerable improvement on 2008 when there were only three. It would appear that the small, devout team of volunteers is doing an excellent job at preventing its becoming extinct at this site; hopefully one day there will be support/funds to help them clear some of the other scrubbed-over seasonal pools on the site and help the population expand.

Araceae

Arum italicum **Italian lords-and-ladies** was recorded from the north-eastern boundary of Oxleas Wood (*LNHS Newsletter* No. 218: 5) on an LNHS Botany Section meeting to Oxleas Wood led by John Swindells on 18 May. Although unrecorded, I suspect the plants were of ssp. *italicum*, the non-native subspecies.

The two species of **skunk-cabbage**, *Lysichiton americanum* and *L. camtschatcensis* were recorded (*LNHS Newsletter* No. 218: 4) on an LNHS Botany Section meeting to West End and Fairmile Commons (vc 17: TQ1262 and TQ1261) led by Paul Bartlett on 10 April. These two species are known to hybridize so intermediates should be looked out for in the vicinity.

Orchidaceae

Jeremy Ison recorded a single specimen of *Anacamptis pyramidalis* **pyramidal orchid** at the northern end of Hackney Marsh, (vc 21: TQ36088623) on 10 June; by 25 July it was destroyed by the 2012 Olympics development.

Mary Smith recorded over a hundred plants, hidden by bracken, of *Dactylorhiza maculata* ssp. *ericetorum* **heath spotted-orchid** from Weald Country Park (vc 18: TQ575955) on 16 June. John Dobson provided an update on the colony of heath spotted-orchids growing at Stanmore Country Park; in 2010 there were approximately forty plants.

A single plant of *Epipactis helleborine* **broad-leaved helleborine** appeared in ‘a scruffy rockery area’ of a small back garden north of East Sheen Common, Richmond (vc 17: TQ1975) and was reported to the Natural History Museum’s Information and Advisory Service based in the Angela Marmont Centre for UK Biodiversity. Bob Creber found one plant with two stems in woodland to the east side of Emerson Park School playing fields, Upminster (vc 21: TQ55888795) on 24 August.

Several plants of *Ophrys apifera* **bee orchid** were recorded (*LNHS Newsletter* No. 218: 12) on an LNHS Botany Section meeting to Hackney Marshes and Wick Woodland led by Russell Miller on 12 June.

Alliaceae

Naturalized plants of *Leucojum aestivum* **summer snowflake** were recorded (*LNHS Newsletter* No. 218: 4) on an LNHS Botany Section meeting to West End and Esher Commons (vc 17: TQ1262) led by Paul Bartlett on 10 April. Although unrecorded, I suspect the plants were of ssp. *pulchellum*, the non-native subspecies.

Tristagma uniflorum **spring starflower** was recorded (*LNHS Newsletter* No. 218: 5) on an LNHS Botany Section meeting to Oxleas Wood (vc 16: TQ442757) led by John Swindells on 18 May. It was also recorded by John Edgington from: among grass beside Queen's Walk, Green Park (vc 21: TQ291800); a front doorstep on the east side of Bloomsbury Street, opposite Bedford Avenue (vc 21: TQ299816); and among paving cracks of inner courtyard at Borrowdale, Robert Street, Regent's Park Estate (vc 21: TQ290827).

Asparagaceae

Probably naturalized plants of *Convallaria majalis* **lily-of-the-valley** were recorded (*LNHS Newsletter* No. 218: 4) on an LNHS Botany Section meeting to West End and Esher Commons (vc 17: TQ1262) led by Paul Bartlett on 10 April. John Edgington also reported it as apparently self-sown in gravel at the edge of paving, Byng Place (vc 21: TQ297821)

Polygonatum × *hybridum* **garden Solomon's-seal** was recorded from the north-eastern boundary of Oxleas Wood (*LNHS Newsletter* No. 218: 5) on an LNHS Botany Section meeting led by John Swindells on 18 May. This plant has been known from this part of the wood for a considerable time but often suffers from heavy trampling in some locations.

Planted *Ornithogalum umbellatum* **Star-of-Bethlehem** was recorded (*LNHS Newsletter* No. 218: 5) on an LNHS Botany Section meeting to Oxleas Wood (TQ442757) led by John Swindells on 18 May. Although unrecorded, I suspect the plants were of ssp. *umbellatum*, the non-native subspecies as there appear to be no historic records for **Star-of-Bethlehem** from Oxleas. John Edgington recorded *Ornithogalum umbellatum* ssp. *campestre* from grass in St James's Churchyard, Piccadilly (vc 21: TQ293804), even though this is the (probable) native subspecies, I have no doubt that the plants are not native to the site.

Arecaceae

Numerous seedlings of *Trachycarpus fortunei* **Chusan palm** were recorded (*LNHS Newsletter* No. 218: 7) on an LNHS Botany Section meeting to London Zoo, Regent's Park led by George Hounsome and Sven Seiffert on 23 May.

Typhaceae (including Sparganiaceae)

Alongside *Baldellia ranunculoides* and *Carex pseudocyperus* at the Glebelands (vc 21: 269910) were several plants of *Sparganium erectum* **branched bur-reed**; these proved to belong to ssp. *neglectum*; the only other subspecies recently recorded in Greater London is ssp. *erectum*. Perhaps further investigation will turn up ssp. *microcarpum* and ssp. *oocarpum*.

Cyperaceae

Carex muricata ssp. *pairae* (previously known as ssp. *lamprocarpa*) **small-fruited prickly sedge** was recorded (*LNHS Newsletter* No. 218: 7) on an LNHS Botany Section meeting to London Zoo, Regent's Park led by George Hounsome and Sven Seiffert on 23 May. This plant seems to be less frequent in Middlesex than *C. divulsa* ssp. *divulsa* **grey sedge** or *C. spicata* **spiked sedge**, the other two widespread members of the *C. muricata* group. Heavily mown and trampled plants of what was likely to be *C. divulsa* ssp. *divulsa* **grey sedge** were recorded (*LNHS Newsletter* No. 217: 10) on an LNHS Botany Section meeting to Holland Park and North Kensington in the graveyard of St Mary Abbots (vc 21: TQ255797) led by John Swindells and myself on 27 February. Bob Creber found three plants of *Carex strigosa* **thin-spiked wood-sedge** in The Manor LNR, Dagnam Park (vc 18: TQ54589271) on 30 May; a little later in the year, on 22 June, he found about 60–70 plants in flower and many more immature plants around a pond in Duck Wood (vc 18: TQ55589238). I counted approximately fifty plants of *Carex pseudocyperus* alongside *Baldellia ranunculoides* and *Sparganium erectum* at the Glebelands (vc 21: 269910) on 18 June whilst with David Bevan and the LNHS Botany group.

Poaceae

On 26 May, Nick Bertrand recorded *Aira praecox* **early hair-grass** growing in abundance as a weed in a raised cobbled area adjacent to Royal Hill and Blissett Street (vc 17: TQ38217700) alongside *Cerinthe major*.

As some LNHS members know, there are two genera of British plants that cause me to break into useless gibbering and total brain shutdown, one is *Epilobium*, the other is *Agrostis*, and so I am always relieved when I see others have the courage or inclination to record these plants. *Agrostis gigantea* **black bent** was recorded (*LNHS Newsletter* No. 219: 7) on an LNHS Botany Section meeting to Beddington farmlands/sewage farm by the edge of a pond (vc 17: TQ2866) led by Derek Coleman on 20 June; I get the impression that this plant is declining in the London Area; certainly I get very few records for it.

Anemanthele lessoniana (previously known as *Stipa arundinacea*) **New Zealand wind-grass** was recorded (*LNHS Newsletter* No. 217: 9) on an LNHS Botany Section meeting to Holland Park and North Kensington (TQ2480) led by John Swindells and myself on 27 February.

Anisantha tectorum **drooping brome** was recorded near the Thames towpath (vc 17: TQ391784) on the LNHS Botany Section meeting along the riverside from Greenwich to Deptford led by Nick Bertrand on 11 July (*LNHS Newsletter* No. 219: 10). I must admit to struggling to get my head around recognizing this plant and 'just could not see it' for some reason; it took the common sense of others (particularly Ian Kitching and George Hounsome) to get me to see the obvious. Worryingly, I did exactly the same thing with the same species when David Bevan presented material to me in 2008 at Camley Street Natural Park!

Victoria Shepherd recorded an unknown grass that was identified as *Calamagrostis epigejos* **wood small-reed** by John Dobson from a newly dug scrape on the New Heath, Stanmore (vc 21: TQ1574994154) on 8 July. This is an excellent find as this grass is now very scarce in Middlesex, the only recent record being near Feltham in 1995.

Catapodium rigidum ssp. *majus* **fern grass** was recorded (*LNHS Newsletter* No. 219: 8) on John Swindells's 'Pot luck in the East End' LNHS Botany Section meeting to Whitechapel and Bethnal Green in a car park on New Road and Vine Street (vc 21: TQ336810) on 29 June.

Mary Smith recorded several hundred plants of *Cynosurus echinatus* **crested dog's-tail** scattered on sandy soil in groups along the verge of the A1306 north side, Rainham on 27 May (vc 18: between TQ53578216 and TQ53728204).

Nassella tenuissima (previously known as *Stipa tenuissima*) **American needle-grass** was recorded (*LNHS Newsletter* No. 217: 9) on an LNHS Botany Section meeting to Holland Park and North Kensington (TQ2480) led by John Swindells and myself on 27 February. It was also recorded (*LNHS Newsletter* No. 218: 7) on another LNHS Botany Section meeting to London Zoo, Regent's Park led by George Hounsome and Sven Seiffert on 23 May. Mary Smith and Bob Creber found it, all self-sown from gardens, in four monads in South Essex (TQ5586, TQ5585, TQ5993, and TQ5386) between them during June to August.

Although apparently locally frequent in parts of north and east London (particular Islington and Haringey) *Poa infirma* **early meadow-grass** appears to be infrequent elsewhere in Greater London; it was recorded (*LNHS Newsletter* No. 217: 10) on an LNHS Botany Section meeting to Holland Park and North Kensington (TQ2480) led by John Swindells and myself on 27 February.

Puccinellia distans **reflexed saltmarsh-grass** is normally found on salted roadsides in Greater London and then only occasionally. It was interesting to find it away from the road in more typical habitat on the Thames Pathway (vc 17: TQ4097915) during the LNHS Botany Section meeting from Greenwich to Deptford led by Nick Bertrand on 11 July (*LNHS Newsletter* No. 219: 10). Not much further east typical salt-tolerant plants such as *Apium graveolans* **wild celery**, *Aster tripolium* **sea aster**, *Glaux maritima* **sea milkwort** and *Sagina maritima* **sea pearlwort** started to become frequent.

References

ANGIOSPERM PHYLOGENY GROUP, THE. 2009. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III. *Bot. J. Linn. Soc.* **161**(2): 105–121.

BURTON, R.M. 1983. *Flora of the London Area.* London Natural History Society.

BURTON, R. M. 2007. Botanical Records for 2006. *Lond. Nat.* **86**: 175–184.

KENT, D.H. 1975. *The historical flora of Middlesex.* The Ray Society, London.

KENT, D.H. 2000. *Flora of Middlesex, a supplement to The historical flora of Middlesex.* The Ray Society, London.

POLAND, J. and CLEMENT, E. 2009. *The vegetative key to the British Flora.* BSBI.

SPENCER, M. 2008. Botany report for 2007. *Lond. Nat.* **87**: 175–191.

SPENCER, M. 2010. Botany report for 2008 and 2009. *Lond. Nat.* **89**: 117–131.

STACE, C. 2010*a*. *New flora of the British Isles*, Ed. 3. Cambridge University Press, Cambridge.

STACE, C. A. 2010*b*. Classification by molecules: what's in it for field botanists? *Watsonia* **28**(2): 103–122.

Obituary

RONALD MALCOLM PAYNE, FLS, FRES, 1922–2010

Ron Payne died on 2 December 2010 aged eighty-eight. He joined the London Natural History Society in 1942, and until his work took him away from London in 1966 he was very much involved in our activities, especially botany and entomology, starting in his teens with Coleoptera, then Odonata and Orthoptera, and later, Diptera. He was made an honorary vice-president in 1967.

Ron was born in 9 June 1922 in Balham, the only child of Lawrence and Winifred Payne. The family moved to Richmond in 1926 and he was educated at Broomfield House private school in Kew and at East Sheen County School. His father, Lawrence Gilbert Payne (1893–1949), a botanist specializing in ferns, was active in the LNHS from 1923 and was president from 1946 to 1948. Two uncles were also naturalists but there had been no previous interest in entomology in the family. Ron related how he had become an entomologist at the age of seventeen when an uncle gave him a copy of *Common British Beetles* by the Revd C. A. Hall. This awakened his interest and started him on Coleoptera, encouraged by finding a dung beetle *Typhoeus* at the mouth of a rabbit burrow on Ham Common, Surrey.

Ron was secretary of our Entomology Committee from 1943 to 1953 (except for one year, 1946), but remained on the Committee until 1966. It was possibly Ron's interest in beetles that induced his father to take up the group and they built up a joint collection during the 1940s. Both were involved in our Survey of Bookham Common, Lawrence Payne contributing an article on the beetles of the Common in the same issue of *The London Naturalist* as Ron's paper on the Odonata (*LN* **24**, 1945). Another early interest was the Orthoptera, and he searched for these insects in many parts of Britain. He failed in one instance when looking for the sickle-bearing bush-cricket *Phaneroptera falcata* in suitable locations in west Cornwall where it had been recorded on two occasions in the 1880s. Few people write up negative records,

427088-1001

but Ron published this experience as ‘A disappointing day at Porthgwarra’ (*Ent. Rec.* **81**, 1969). Ron wrote an important paper on the ‘strangely neglected’ Orthoptera under the title ‘The distribution of grasshoppers and allied insects in the London Area’ (*LN* **37**, 1958). This paper provided a useful baseline against which to view the changes in distribution since then. However, in 1980, he declared ‘Orthoptera, that’s a young man’s game . . . . I cannot hear them any more.’

Ron’s career was in the Civil Service, in which he rose through the grades after joining the Board of Trade in 1939. He was not called up for active service in the Second World War due to a heart weakness, but he enlisted in the Home Guard. During the war he spent three years in Leicester where he contributed notes on the local dragonflies in 1944 and 1945, and the Orthoptera in 1946. He returned to London and married Sheila Groves, a fellow civil servant, in 1948. From the early 1950s they lived at Loughton in Essex where their two daughters, Maggie and Heather, were born.

It was while at Loughton that Ron began his interest in the Diptera, starting to publish on this order in 1960 with the craneflies which he collected whilst on holiday in the Lake District, Derbyshire, Galloway and central and south Wales. He also published on the craneflies of Thorndon Park and Epping Forest. His first botanical paper appears to be ‘The ferns of Epping forest’ (*LN* **39**, 1960) in which he notes that ‘in ten years’ acquaintance with the Forest I have in fact seen all but one of the species now found in the London Area growing within a radius of four miles of the “Wake Arms”, a popular meeting-place in the centre of the Forest.’

Ron worked in London until 1966 when he moved to the Investment Grants Office in Cardiff. Whilst in London, however, it was when he was most active in the LNHS. As well as the Entomology Committee, mentioned earlier, he served on Council from 1948 to 1953, he was our Nature Conservation Committee representative for Essex from 1952 to 1961, he served on the Botany Committee from 1952 (or possibly earlier) to 1964, he edited *The London Naturalist* from 1953 to 1967, and he served on our Epping Forest Field Section Committee from 1959 to 1966.

Ron’s stay in Wales was brief, as on 19 February 1969 he was promoted to CEO and moved back to Essex to work in the Customs and Excise office in Southend, and the family then lived at Westcliff-on-Sea. This part of Essex is relatively unexciting for craneflies, so Ron turned his attention to the hoverflies, publishing an account of ‘The hover-flies of Essex’ in the *Essex Naturalist* **33** (1975). Also, at this time, he developed an interest he had begun a decade earlier and produced a series of papers recording the insects visiting flowers. Whilst at Westcliff, Ron was active in both the Essex Field Club and the South Essex Natural History Society. In 1975 he was elected to the Council of the latter and he became its vice-chairman for a while in 1978.

In 1978, Ron and Sheila moved to East Harptree in the Mendips when he took up the post of Deputy Collector of VAT for the West Country. Whilst there he joined the Bristol Naturalists’ Society and became president of the Society and chairman of its Entomology and Botany Sections simultaneously — the first person to do this. During his stay in the Mendips Ron’s interests began to move to botany, especially the grasses, which had been a lifelong interest and on which he became an acknowledged expert. Ron’s grass collection was started in 1943 whilst he was in Leicester. He had been encouraged by C. E. Hubbard to collect grasses from the Midlands for Kew. He amassed a large collection from all over the world, including many from other collectors, and he eventually became the BSBI’s referee on alien grasses. His collection was donated to Reading University in 2004. It comprised 4,500 sheets representing over 1,750 species. Ron was reputed to have seen all British species of grasses except *Poa flexuosa*. Ron’s Diptera collection was passed to Bristol Museum and Art Gallery. While in the Mendips he was involved in the Bristlol Flora project and subsequently contributed the section on arable weeds and walls in *The Flora of the Bristol Region* (2000).

Ron joined the Botanical Society of the British Isles in 1947. He took part in many of its field meetings, including foreign tours, and he also led botanical tour holidays to the Alps and the Mediterranean, including Morocco with Frank Perring. He regularly attended the BSBI's Annual Exhibition Meetings.

Ron retired from the Civil Service on 4 June 1982 but he and Sheila remained at East Harptree until 1991 when they moved to Watlington in Norfolk. Whilst there he became involved in the Norfolk Flora project and made a major contribution to the *Flora of Norfolk* (1999). He also made many local botanical contributions and was an active member of the Norfolk and Norwich Naturalists' Society. Initially he contributed to their journal but later he published most of his botanical work privately, for example, *The flora of roofs* (2000), which was reviewed in *LN* **80**, 2001, and *The flora of Ely* (2002), reviewed in *LN* **83**, 2004.

Following Sheila's death in 2007, Ron returned to Westcliff-on-Sea where he spent the remainder of his life in a flat on his own. He then rejoined the South Essex Natural History Society. He had by then abandoned his entomological interests and was suffering from impaired eyesight. Undaunted, he set about making a study of the flora of walls right across south Essex. Unable to drive, Ron used the rail network to visit large numbers of towns, and, in particular, churchyards, right up to Stratford and Barking in the East End of London. Whenever possible he would get out into the field every day during the flowering season. From January 2008 until within a few weeks of his death, he would send his handwritten list of plants to Ken Adams (BSBI recorder for Essex) on a daily basis by first-class post. In response to the suggestion that he should save them up and post them once a week to save on postage, he replied that he might 'pop off' one day before the end of a week and the records would be lost. In addition, any plants he could not name were sent immediately through the post to either Gillian and Ken Beckett or Ken Adams for 'instant' (chased up by a phone call the following evening) identification. Only a short time before his death he had cataracts removed from both eyes in quick succession. This did not stop him botanizing however; he was out there again the day after each operation, delighted to be able to see in detail once again. He reckoned that the antibiotics would prevent any problems.

As mentioned earlier, Ron had donated some of his collection to museums. This usually happened when his interests changed and shortly before moving to a new area. However, the location of his earlier Coleoptera collection, including specimens collected by his father, is uncertain. It was thought that it was given to the Natural History Museum in the 1960s, before he moved from Loughton, but there appears to be no record of its receipt. Any information on the whereabouts of beetles collected by R. M. or L. G. Payne would be appreciated.

Throughout his life, Ron's greatest contribution was to local societies with which he had been involved wherever he was based, and he served these societies in many ways. He always gave encouragement to beginners and the undersigned is one of many in the LNHS who benefited from Ron's presence at Entomology Section meetings, especially the informals, at which he was a valued participant.

We are grateful to Ron's daughter Maggie Gibson for biographical details and for the photograph of Ron included here. We also thank Ken Adams; and Peter Chandler and Roger Hawkins for allowing us to base much of this tribute on the more-detailed appreciation that is being published by the British Entomological and Natural History Society, together with a complete bibliography of Ron's publications.

KEITH H. HYATT

Book reviews index

Mosses and liverworts of Britain and Ireland: a field guide. Edited by Ian Atherton, Sam Bosanquet and Mark Lawley 20
Wild flowers. Sarah Raven 46
The tiger: soul of India. Valmik Thapar 82
A new atlas of the Kent flora. Eric G. Philp 155–156
Trees of Britain and Ireland. History, folklore, products and ecology. Edward Milner 178
Guide to British freshwater macroinvertebrates for biotic assessment. Compiled by Simon Pawlet 186
Developmental biology. A very short introduction. Lewis Wolpert 200
The animal kingdom. A very short introduction. Peter Holland 200
History & mystery. Notes & queries from the newsletters of The Society for the History of Natural History. Edited by Charles Nelson 206
Plant galls. Margaret Redfern 210
Weeds: how vagabond plants gatecrashed civilisation and changed the way we think about nature. Richard Mabey 234

The London Naturalist

Instructions to contributors

Submission of papers

Papers **must be submitted in duplicate** to the editor, Mr K. H. Hyatt at his home address, 1 Tremcelynog, Rhandirmwyn, Llandovery, Carmarthenshire SA20 0NU. Please contact the editor before the end of January if you wish to contribute to the forthcoming issue. However, the editor may be contacted at any time on 01550 760346 to discuss possible contributions, and will be pleased to send a recent offprint to show our style, and as a guide to preparing the manuscript, **which should be followed as closely as possible in regard to layout and typefaces.** Manuscripts **must be double spaced throughout on one side of the paper only** and with wide (3-cm) margins. **Authors must retain a copy.** Papers should include at the beginning an **abstract, summary** or **synopsis. Sheets must be numbered.** Papers are peer-reviewed as appropriate. **After acceptance**, the editor would be pleased to receive contributions as Microsoft Word-compatible files (or they can be e-mailed to the printer) **together with two matching hard copies of the final text.** Papers should be relevant to the natural history and archaeology of the London Area. This includes comparisons between London and its surrounding countryside with other localities, as well as work relating to or comparing species or habitats which occur in the London Area. Contributions of relevance nationally will also be considered.

Text

Locality spellings should follow the latest editions of maps published by the Ordnance Survey. Capitalization should be kept to a minimum. Common names of animals and plants must begin with lower-case initials (except for proper nouns), and **only** Latin names of genera and species must be underlined unless typed in italic. When both common and Latin names are given there should be no brackets or commas separating them. **Genus names should appear in full where first used within each paragraph.** When scientific names are taken from a standard work, which must be cited, authorities may be omitted. In descriptive matter numbers up to a hundred should be in words, except in a strictly numerical context. Dates should follow the logical sequence of day, month, year, i.e., 25 December 1971, but in lists may be as 25.xii.1971. Measurements should be in metric and follow the SI system (Système International d'Unités), with imperial equivalents in parentheses where appropriate. There should be no full point following Dr, Mr, Mrs, or St. Lists should be in systematic, alphabetic or numerical order. **Hyphens should not appear at the ends of lines** as the right-hand margins of manuscripts do not need to be justified: **turn off the hyphenation option. Tables and figure legends should be typed on separate sheets at the end of the text. Word-processed text should not use italic, bold or compressed typeface. Paragraphs should be indented. Sentences must not begin with numerals. Footnotes and endnotes should be avoided.**

References

Reference citation should follow the examples given below. Capitalization in titles of books and papers in journals should be kept to a minimum. Journal titles should be in full, or follow the abbreviations in the *World list of scientific periodicals,* and be underlined or in italics. Book titles should also be underlined or in italics. Examples are as follows:

In text:

Meadows (1970: 80) or (Meadows 1970).

In references:

MEADOWS, B. S. 1970. Observations on the return of fishes to a polluted tributary of the River Thames 1964–9. *Lond. Nat.* **49:** 76–81.

MELLANBY, K. 1970. *Pesticides and pollution.* Ed.2. Collins, London.

WHITE, K. G. 1959. Dimsdale Hall moat, part II. *Trans. a. Rep. N. Staffs. Fld Club* **92:** 39–45.

Authors must ensure that all references are cited accurately: they will not be checked by the editor.

Illustrations

Distribution maps should be submitted in the form of a recording map with symbols in Indian ink and stencilled or by transfers. Solid dots are used to indicate contemporary or recent presence, circles for old records, and crosses (not pluses) for other information, such as introduced species. The caption should be written outside the frame of the map and will be set up by the printer. Scale bars must be included **within** the frame of the map.

Line drawings should be in Indian ink on white card or tracing paper, larger than the printed size, but no larger than A4. Place names, etc., must be produced with stencils or with sharp typing. Captions should be separate as they will be set up by the printer, but keys that include special characters should be included **within** the border of the figure.

Photographs should be glossy black-and-white prints, of good contrast, preferably plate or half-plate in size, or, following consultation with the editor, in the form of colour transparencies, either 35 mm or larger. Colour prints are also suitable for reproduction in the text in black and white.

Computer-generated illustrations must be sharply defined and preferably be supplied digitally.

Proofs

Proofs will be sent to authors for scrutiny, but only essential corrections can be made at that stage.

Offprints and reprints

Up to 25 free, unbacked offprints will be supplied on request. Additional copies may be purchased if ordered when the proofs are returned.

Backed and folded, wire-stitched reprints, with or without covers, may be purchased by authors following consultation with the editor.

No. 90

The London Naturalist

2011

Non-native herpetofauna in London . . . . *Frontispiece*
Officers for 2011 3
The Society's Recorders 4
Report of the Society for the year ending 30 June 2010 6–12
Official and sectional reports for 2010 13–19
EDGINGTON, JOHN — Early London botanists '. . . in the fieldes aboute London, plentuously . . .' 21–45
MCALISTER, ERICA — The Entomology collections at the Natural History Museum — from collection enhancement to public outreach 47–54
BEVAN, DAVID — Coppicing Haringey's ancient woodlands 55–81
LANGTON, TOM E. S., ATKINS, WILL and HERBERT, CLIVE — On the distribution, ecology and management of non-native reptiles and amphibians in the London Area. Part 1. Distribution and predator/prey impacts 83–155
LANGTON, TOM E. S. and HERBERT, CLIVE — On the distribution, ecology and management of non-native reptiles and amphibians in the London Area. Part 2. Disease impacts, perspectives, trade exploitation and finding ethical solutions 157–177
PLANT, COLIN W. and TERRY, RACHEL — Third update to the list of microlepidoptera of Middlesex (vice-county 21) 179–185
WILLIAMS, L. R. — London butterfly monitoring report for 2010 . . . 187–199
ANDERSON, NEIL — Odonata report for 2010 201–205
BANTOCK, TRISTAN — Hemiptera report for 2010 207–209
Survey of Bookham Common: sixty-ninth year
Progress report for 2010 211–233
SPENCER, MARK — Botany report for 2010 235–252
Obituary:
RONALD MALCOLM PAYNE, 1922–2010 253-255
Book reviews index 256

ISBN-10: 0901009288

Published December 2011

© London Natural History Society

c/o The Linnean Society of London,
Burlington House, Piccadilly, London W1J 0BF

www.lnhs.org.uk

£8

9 780901 009289